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A January Blockade

THE conditions of our electrical export trade are fairly well disclosed by the statistics of January, now available, showing that what we have lost in old markets has not yet been made up in new or those relatively uncultivated. The exports for January were $1,773,938, as compared with $1,947,646 a year ago, and the total for seven months is more than $5,000,000 below that of the corresponding period. No one can get any particular comfort or cheer out of such figures, unless they be regarded as marking the extreme of decline and the beginning of a new upward movement. That is conjectural. We are off with the old loves, and not yet on with the new, and it is obvious that the transfer of affection is likely to take some time. Here is a ready and responsive market, but in these days purchasing power has been dulled abroad, and whatever activity it may show is chiefly directed toward food and fireworks. We sold six times as many "explosives" in January of this year as we did in the same month of 1914. What electricity means for the comfort, convenience and happiness of mankind is fairly well known. On that is based our export trade. What there is in the deviltry of the "explosive" branch of industry that makes for human happiness still remains to be explained by the devotees of militarism who are mortgaging the blood of this generation and the sweat of generations to follow.

Maximum Rate Lowered in New York

THE reduction in New York Edison Company rates, as expressed in the Public Service Commission order, is merely a lowering of the maximum rate for customers of minimum requirements. Responsibility for scientific rate-making for other customers is left to the company. The order does not solve rate-making problems upon the successful handling of which the market for energy in large quantities, and hence profitable operation, really depend. As this case shows, high profits usually mean to central-station regulators that the maximum rate is above the proper limit and should be brought down. Local political expediency also appears to be a large factor in the decision. Another and better way to effect rate reduction than either voluntary company action or commission order is open. If there could be a definite financial incentive, as in the Boston sliding gas scale, undoubtedly efficiency, economy and experimentation would be accelerated. To allow increased dividends as compensation for lower rates is less simple with complicated electric schedules than with flat gas rates. However, it is well worth earnest study.

Commissions and Security Prices

THE comment in the annual report of the Missouri Public Utilities Commission upon the small number of applications for authority to issue securities indicates an appreciation of the serious financial results of the war. That "it has been almost impossible" for any public utility in the State to sell securities the commission is fully convinced. A company hesitates to advertise inability to sell securities, because such a confession may prove to be a boomerang that weakens credit; but since uncontrollable conditions have depressed security prices and curtailed borrowing it is highly important that regulators understand the situation. That the market for new securities has been poor is an accepted condition, but the main question is of the future. Out of the confusion caused by the European war new relations will arise between lenders and borrowers of which commissions will take cognizance.

Cost of Lamp Renewals

IN the New York Edison Company maximum-rate adjustment 0.5 cent per kw-hr. is regarded as the value of lamp-renewal service. Small consumers may pay 8 cents per kw-hr. for energy alone or, if they so desire, the first lamp installation and subsequent renewal service may be obtained by a payment of 0.5 cent per kw-hr. for lamp service. Although not applied previously to small consumers, this allowance for lamp-renewal service has been provided for heretofore in rate schedules for large-quantity consumers. It is based upon assumed average life, cost of delivery and other direct expenses. The estimated costs of this service are greater to the company than the price it charges, but the company maintains that its service is dependent to so large an extent upon high lighting standards that it protects itself by offering consumers every inducement to use carefully tested, efficient lamps. Although interesting as an individual solution, this plan should be subjected to close analysis by other companies before adoption, as local conditions vary greatly.

Protection of Signaling Systems

WITH the ever-increasing installation and ramification of wires in cities, for all kinds of service, it has long been recognized that systems could advantageously be divided into two classes, namely, the signaling systems such as telephone, burglar-alarm and fire-alarm systems, operating at a relatively low voltage, and the energy transmission and distribution

systems. It has long been recognized that it is necessary to protect the signaling circuits against the possibilities of accidental contact with the energy-carrying systems. This necessity tends steadily to increase. With telephone circuits are commonly used devices for protection against both lightning and distributing systems of higher voltage. In the *Elektrotechnische Zeitschrift* Dr. Fritz Schröter recently described a new form of voltage protector consisting of a particular type of vacuum tube. Vacuum tubes have been used as lightning protectors on signaling circuits for many years, but ordinarily they require a considerable impressed voltage to break them down, and hence they fail to protect against 220 volts or less. The vacuum tube, as described in the article, is able to break down or give passage to a current under an impressed emf not greater than 130 volts. The vacuum tube, which is of relatively small dimensions, is provided with an anode of aluminum wire, as well as a cathode of alkali metal or alloy. The gap between the anode and the cathode is only a few millimeters. The tube contains either helium, neon or argon gas at a pressure of about 2 mm mercury.

Fixation of Atmospheric Nitrogen

The problem of catching and fixing nitrogen is of great importance to human beings. As we all know, we live in an ocean of nitrogen diluted with a certain amount of oxygen and other gases. Although we breathe it perpetually, we are not supposed to retain any nitrogen in the process. As much nitrogen is exhaled in the course of a year as is inhaled. Yet we must have a certain amount of nitrogen for our bodies or die. We obtain it either from plants directly or from the flesh of animals that have themselves obtained it from plants. Plants have difficulty in securing enough nitrogen for their needs, when their growth is stimulated, as in farm crops. When the soil becomes exhausted of nitrogen by the plants, these wither or fail to develop properly. The replenishment of nitrogen to the soil comes slowly in the regular course of events. In thunderstorms the lightning flashes are believed to fix a small amount of nitrogen by union with oxygen in their flame, and this becomes washed down to the soil by rain. Moreover, certain families of plants harbor on their roots bacteria which seem to be able slowly to build up a stock of soil nitrogen. Certainly cheap nitrogen soil food, with suitable additions of phosphorus and potassium, is of great agricultural value for forcing crops without delay in rotation.

At a recent meeting of the American Institute of Electrical Engineers a paper was presented by Mr. Leland L. Summers on the fixation of atmospheric nitrogen, in which it was pointed out that, although several electrical processes are in commercial operation for fixing atmospheric nitrogen, thunderstorm-fashion, in specially constructed furnaces, yet they develop a low efficiency owing to the large amount of heat needed to raise the temperature of the incoming nitrogen and oxygen. The idea is suggested that combinations of electrical and chemical methods promise important improvements. At the present time nearly all of the world's supply of nitrogen is confined to the saltpeter beds of Chile and Peru. Half the output of these goes for the manufacture of explosives. The total destruction of this stock during the last six months must have been enormous.

Electrical Cooking

An important paper by Mr. W. R. Cooper on electric cooking was recently read before the (British) Institution of Electrical Engineers. Although the prices and conditions outlined are those encountered in British practice, the general situation is quite easily comparable with that in America. The writer, who will be recognized by our readers as the accomplished editor of the London *Electrician*, speaks of trying electric cooking in his own home, and therefore approaches the subject from the standpoint of the consumer who pays the bills. Use was made of an electric range having a full-load rating of 5450 watts. This proved adequate for the complete cooking for a family of eight. The average consumption was found to be about 2 kw-hr. per person per day in the winter time and about 1.6 kw-hr. in the summer. The total energy for the year was just over 5000 kw-hr., and the price, including the installation charge, averaged 2.08 cents per kw-hr., the total charge amounting to nearly $110 for energy. The hot-water matter, always difficult in dealing with electrical cooking, was taken care of in the way rather customary in and about London when electrical cooking is employed, namely, by means of a small coke-burning separately fired boiler. This boiler cost about $50 set up, and the fuel cost about $33 per year.

Without going too far into details, the new régime cost about one-third more than the old, all things considered, in spite of the low average price of energy. Aside from the cost of working the separate hot-water plant, the difference was far less striking, but from any viewpoint it is sufficiently plain that there is room for considerable improvement in the efficiency of electrical cooking apparatus, and that something near a 2-cent rate must be reached in order to compete with even so inefficient a heater as the coal range. At or near this price, however, with cooking apparatus well designed and properly heat-insulated, electrical cooking, even on the scale required for the complete use of the household, becomes economically feasible. The diversity factor of the cooking load is large, and in English practice the cooking is not a peak load in the sense of falling upon the lighting peak. Moreover, the noon hour, which furnishes a conspicuous valley in the motor load, provides a peak in the cooking load which again improves its character as a component of station business. Mr. Cooper criticises with keen intelligence the practical points found in the working of an electric range and makes some excellent suggestions regarding improvements. Although in his own personal experience the cost of electric cooking was in excess of that

when coal was used, he notes that certain low-rate schedules already in use would have brought the costs to practical equality under the very same conditions of use. In other words, it is possible even now at the price actually charged by central stations generating their electrical energy from steam to make electric cooking an economic success. It will be found even more successful when the schedules take suitable account of the advantages of cooking as a central-station load.

The Telegraph and Multiplex Telegraphy

It has been long an axiom with telegraph engineers that the next important development in telegraphy must be in the direction of page printing, in which the message is printed on a regular telegraph blank in roman letters. Among the numerous attempts that have been made to develop a system of this type may be mentioned the Buckingham, the Barclay and the Murray page printers, the first two of which have been extensively used in this country. With these systems there has been acquired on circuits 1000 miles in length a speed of from eighty to ninety words per minute in two directions, thus giving an effective transmission of about 170 words per minute, which appears to be the maximum speed attainable with these systems, a fact attributable measurably to the limiting electrical factors of the circuit.

Even apart from the electrical limitations of the circuit, practice has shown that the mechanical limitations of the printing mechanism are reached, although not exceeded, at the speeds mentioned, owing to the excessive wear and tear of the apparatus. These and other causes led certain investigators to endeavor to obtain greater message-transmitting capacity from existing wires by means of a combination of the well-known Baudot multiplex tape printer and the Murray page printer. This combination, with certain modifications and improvements, has resulted in a reliable page-printing telegraph system, by means of which four forty-five-words-per-minute messages are transmitted in two directions over one wire, or a total of 360 words per minute per wire, as described by Mr. Paul M. Rainey in another part of this issue. As the author intimates, the engineers of the company which has developed this multiplex printer have not proceeded in a haphazard manner in the development of the system. The merits and the defects of the high-speed printers mentioned were well known to those engineers, as were also the merits and the demerits of the automatic system of the Wheatstone type. The Wheatstone automatic system transmits messages at a high speed over long circuits, but the messages are received as dots and dashes which must be transcribed by clerks at a comparatively low speed. A comparison of the cost of labor for the transcription of messages received by the automatic system and the cost of construction and maintenance of lines of systems operating at lower speed but involving the least labor costs was no doubt made by these engineers, and it may be assumed that the decision to adopt the multiplex page printer described in Mr. Rainey's article was due to results favorable to that system in the comparison. It is known that the Baudot instrument is in operation in Europe at a total rate of about 280 words per minute, with the tape-printing feature of the original Baudot system retained. Obviously, the additional functions demanded by a page printer as compared with a system in which the message is received on paper strips add somewhat to the complexity of the system and also tend to reduce the rate of transmission. However, in the minds of the engineers in this country, the commercial advantages of the page-printing feature have evidently outweighed its disadvantages. In the tape-printing system the strips are usually cut up into sections and pasted on the telegraph blanks for delivery to the addressee, a process requiring labor and time.

A striking feature of the later experiments in printing telegraphy is that in which tape transmission of messages has shown its superiority as compared with direct keyboard transmission by the operators. Tape transmission involves the perforation of the paper strip by a manually operated keyboard perforator, which machine adds considerably to the expense of the installation, but the gain in speed of transmission by perforated paper as compared with direct keyboard transmission is so marked that the expense of the machine perforators is found to be fully warranted.

In his article Mr. Rainey does not specify the circuits on which this multiplex system has thus far been in use, but it is known that one circuit has been in successful operation between New York and Boston, a distance of about 225 miles, for almost a year. From the statement that the system is capable of successful use on any existing circuit over which a line relay can be operated satisfactorily, it may be taken for granted that the distance over which this system may be employed will at least equal that now covered by any other existing long-distance printer, and presumably its use will result in a decided gain in the message-transmitting capacity of these circuits.

Another feature of the multiplex printer which has scarcely been touched upon by Mr. Rainey is the cost of operation, especially as compared with the Morse manual system. Since each operator of the multiplex system prepares messages at the practically forced rate of forty-five words per minute and these messages are immediately transmitted automatically at the same rate of speed and without attention from anyone other than the perforating operator, it is evident that the cost of operation must be small as compared with that of the manual Morse system, on which the average speed of transmission cannot be placed at more than twenty-five words per minute.

No doubt, practical experience with this ingenious and interesting multiplex printer will show opportunity for further development, but as it stands at present one is quite disposed to agree with Mr. Rainey that the advent of this system will mark an epoch in the history of the telegraph.

LETTERS TO THE EDITOR

Evaluating the Isolated Plant

To the Editor of the ELECTRICAL WORLD:

SIR:—In reference to your article on "Evaluating the Isolated Plant," in your issue of March 13, I would state that it has been customary for our engineers to impress upon the mind of the prospective customer the importance of figuring the profit on the plant investment in addition to the usual fixed charges of interest, depreciation, taxes and insurance.

This item of profit is generally mentioned under the caption of "fair profit," and, while its value has not been accepted in some instances by the prospective customer, it has received serious consideration in many others. This, naturally, is to be expected, inasmuch as the earning power of capital is not always so attractive to some manufacturers as to others. It is then more or less a question as to the value of money to each particular individual, and for that reason no fixed percentage may be applied to it which will cover all cases. It reaches its minimum value in those instances where the employment of additional capital would result in no material increase in profit, and conversely it has its greatest value where the employment of additional capital, through expanding business, means large returns.

Practically every manufacturer realizes that it is a losing proposition to invest money in a machine which does not pay for itself in a few years' time. There are few manufacturers, however, who realize that an investment in a private plant, like that in a machine, should also pay for itself in a few years' time, which means that unless the saving effected through the installation of a private plant, compared with the cost of operating under central-station service, is sufficient to pay for the plant during the economical life thereof, central-station service should have the preference. Likewise, if the costs of operating under both methods are identical, central-station service should be employed, as capital is not tied down to a non-productive investment, but is at the command of the company, either to use in expanding the business through advertising or productive measures or to be retained to carry the company over periods of business depression.

While the argument of fair profit is undoubtedly one which has been emphasized only recently by central-station motor-service solicitors, it has been present, no doubt, in the minds of those contemplating the expenditure of funds for plant apparatus and has been the deciding factor in many instances in the past wherein central-station service has logically had the preference over the isolated plant.

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Overheating of Nitrogen-Filled Lamp

To the Editor of the ELECTRICAL WORLD:

SIR:—In reference to your article on the subject "Overheating of 200-Watt Nitrogen-Filled Lamp," with the illustration, published on page 681 of your issue dated March 13, I wish to register the claim that the case cited is an extremely unusual one which could be explained only by a very careful examination into all the circumstances connected with it; and, furthermore, that, since it treats of the very unusual rather than the typical, the article causes impressions in the minds of the readers which are not at all according to the facts. Careful temperature measurements in the laboratory on various designs of 200-watt gas-filled lamps with many combinations of socket and reflector equipment revealed no socket temperatures as high as 200 deg. Fahr., which was supposed to have been the safe operating temperature of the compound used in the socket which you illustrated. The highest temperature found in the wires connecting to the brass part of the sockets was 150 deg. I think that there is little doubt that a 250-watt vacuum lamp or one with slightly higher wattage would have caused the compound to melt from the socket when operated under the conditions of the case you have cited. Instances where 50-watt vacuum lamps have caused socket wax to flow are by no means unknown.

That the lamp base became soldered to the sockets is no indication that the lamps in their normal condition operate the socket at a temperature beyond the melting point of solder. The high temperature which the unit finally attained was no doubt caused by the cumulative effect coming from the radiation absorption of the dark coating which was flowing over the lamp bulb, so that once the compound started to flow the heat began to pile up, and when the bulb became fairly well covered with the black coating it made no difference whether the lamp was gas-filled or vacuum, the accumulation of heat would go on at about the same rate.

The development of the gas-filled tungsten-filament lamps is, without doubt, of great benefit to mankind and to the electrical business as a whole. It does not seem proper to me that the ELECTRICAL WORLD, standing for progress in the electrical art, as it does, and doing so much to promote that progress, should in this particular instance call attention to a single unfortunate circumstance which must react unduly to retard the progress being made in incandescent lighting. The manufacturers of incandescent lamps have not overlooked the heat question, and taking care of the inherent tendency of a gas-filled lamp to have higher local temperatures is merely a problem of engineering and lamp design, which offers no particular difficulty in its solution.

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[Progress in the development and introduction of new types of apparatus is accelerated, not retarded, by ascertaining the conditions under which they should not be used as well as the conditions under which they prove most satisfactory. There can be no doubt as to the satisfactory service rendered by the high-efficiency incandescent lamps when properly installed and operated, as we have pointed out on numerous occasions, but it is unsafe to assume that since these lamps are capable of giving excellent satisfaction, no attention need be paid to the other devices with which they are associated. In the article referred to by our correspondent attention was directed to the fact that the heat from 400 nitrogen-filled tungsten lamps, each rated at 200 watts, had so melted the filling compound in the lamp receptacles in which they had been inserted that in each case the black filling compound ran down over the base and bulb. The article served to show that care must be exercised in selecting sockets in which to install the lamps indicated. It is important for our readers to know that not all combinations of sockets and lamps, each excellent in itself when used properly, will prove satisfactory —information which has not previously been so widely disseminated as to make an impression on the persons responsible for the selection of the combination to which attention was directed in our article.—ED.]

NATIONAL ELECTRICAL SAFETY CODE

Proposed Rules Formulated by the Bureau of Standards in Co-operation with Various Interested Bodies

BY EDWARD B. ROSA, CHIEF PHYSICIST OF THE BUREAU OF STANDARDS

The Bureau of Standards has been engaged for more than a year in the preparation of a proposed National Electrical Safety Code. In this work it has had the cordial co-operation of some of the state public service and industrial commissions, city electrical inspectors, engineers of companies operating electric light and power, railway and telephone utilities, manufacturers of electrical machinery and appliances, committees of engineering societies, the electrical committee of the National Fire Protection Association and the Workmen's Compensation Service Bureau. Without such co-operation the work would have been unsatisfactory or impossible. With it, considering the magnitude of the task, progress has been rapid and the work has been pleasant and the results to date satisfactory. Before the proposed code is published for adoption it will be submitted to a large conference in Washington for criticism and ratification, and it is hoped to secure general approval not only of all its main features but of substantially all its provisions before it is offered to state commissions and municipalities for adoption.

Aside from a preliminary announcement at the 1913 convention of the National Electric Light Association and a brief statement of the progress of the work by Director Stratton some months ago [see ELECTRICAL WORLD, Dec. 19, 1914, page 1188—Eds.], nothing has been published by the bureau concerning this work, except the preliminary edition of the operating rules issued as Circular No. 49 last summer. It therefore seems proper to give some account of what has been done and how the work has been conducted before the preliminary draft of the construction rules is issued for general discussion and criticism.

The Need of Such a Code

The attention of the bureau was drawn several years ago to the need of a national safety code for electrical practice. Relatively few companies possessed printed sets of operating rules, and these were far from complete. There were no construction rules framed from the standpoint of the life hazard, although the Underwriters' Code contained some rules that had a greater bearing on the life hazard than on the fire hazard. These rules have exerted a powerful influence toward securing better electrical construction and reducing the fire hazard, and it was obvious that, if a life-hazard code could be formulated and maintained as successfully as the fire code has been, it would have a potent and salutary influence in unifying practice and reducing accidents. It was evident, however, that the preparation of such rules in a form that would be adequate and satisfactory would be no easy task. They should include operating rules for employers as well as for employees, and construction rules for generating stations and substations, transmission and distribution lines, and the great variety of electrical machinery and apparatus which utilizes electrical energy. To prepare a single reasonably complete code, that could be adopted and administered by state industrial commissions, public service commissions and city officials, and which would be accepted as generally as the Underwriters' Code has been, appeared to be a most important service for some agency to perform. The alternative would be different rules in different states and cities, and then perhaps after years of confusion some unifying influence would bring order out of chaos, as the electrical committee did with respect to the fire code.

The Agency to Prepare Such a Code

Evidently an agency that could study the subject thoroughly with an open mind, conferring with all the various interests concerned, and prepare and discuss successive drafts of a proposed code with those who were most familiar with the various phases of the subject would be more likely to obtain a satisfactory result than any single interest or individual. It was thought that the Bureau of Standards occupied a favorable position for such an undertaking. It is a scientific institution which deals not only with scientific questions but also with engineering and industrial problems, and represents the public in the most general sense. Its engineers are trained to look at engineering problems which have a public relations aspect from the standpoint of the utilities concerned as well as the public, and to consider the effect on service and the cost of operation of proposed measures as well as the ostensible advantages to the public which are to be attained. While not forgetting the company's interest, they do not, however, neglect the public's interest, but always strive to maintain an even balance between all the conflicting interests that may be involved. Inasmuch as no other national agency seemed likely to take up the work, and it appeared to be directly in line with other work which the bureau was doing, Director Stratton asked Congress more than two years ago for authority and a special appropriation to enable the work to be done. The appropriation became available on July 1, 1913.

The plan which has been followed was outlined in advance in a paper presented by the writer at Chicago nearly two years ago. It was not, of course, expected that the bureau would employ talent enough to compile such a code from its own knowledge. On the contrary, engineers of ability and experience were appointed who were expected to study the subject thoroughly and then gather from the most competent and experienced engineers of the country their views and the results of their extended experience. The rules in force in various European countries were studied, and all the books of rules in use by operating companies in this country were collected and examined. All these sources of information enabled a first rough draft of a set of rules to be prepared after one year's study.

In the meantime the N. E. L. A. had appointed an accident committee, with which the bureau had been cooperating at the request of the committee. However, during the first year of the committee's existence agreement was reached only as to a few operating rules, these being general precautions for employees. Most of the work concerned other aspects of safety.

Preliminary Operation Rules

The bureau issued the first instalment of its proposed code on Aug. 1, 1914, as Circular No. 49, entitled "Safety Rules, to Be Observed in the Operation and Maintenance of Electrical Equipment and Lines." This was a first edition intended to be preliminary, the introduction of which stated: "We particularly request additional constructive criticism, suggestions and data for use in preparing a second edition of the rules." Several thousand copies of these rules were distributed to companies, commissions and individuals requesting them, and several hundred letters were received containing the comment and criticism which had been invited. Most of the comment was distinctly favorable, although a great many criticisms were made of various rules and suggestions were given for improvement.

The N. E. L. A. accident committee for the current year also sent out these rules (with some modifications of its own) and received a large number of letters from members suggesting changes. The representatives of

the bureau spent three entire days (in two meetings in January and February) with the N. E. L. A. accident committee, going over the operating rules and the various suggestions and criticisms, and came to a complete agreement respecting all criticisms offered by the committee and its conferees and proposed by the bureau, and revised the set of rules in a way satisfactory both to the committee and the bureau. The rules as revised were then sent out again for a final criticism before publication. The final criticisms were few and concerned details. In most cases they were such as could be provided for satisfactorily, and at a conference March 26 between the committee and the representatives of the bureau some final changes, mostly of a minor character, were agreed upon.

Many companies have adopted the first edition of the rules and many others have indicated their intention of adopting the revised set of rules. The bureau is greatly gratified by the favor accorded the first edition, which was recognized to be imperfect, but which it was thought could be perfected better by issuing a large first edition for general criticism than by holding the rules back until they were nearer to perfection. The bureau is under great obligations to the N. E. L. A. accident committee for its assistance and co-operation, and feels that the rules are much more satisfactory than they would have been without its critical examination and co-operation in the revision.

Relations with Fire Protection Association

While this study and development of the operating rules was progressing, the construction rules were being formulated. It was found of, course, that there was a very close relation between the Underwriters' electrical code for fire prevention and the construction rules of the proposed electrical safety code. Hence a close working arrangement was desirable with the electrical committee of the National Fire Protection Association, which had the responsibility of revising the existing code this winter, and with the committee on safety to life. At the instance of the chairman of this committee, Mr. H. W. Forster, a conference was held in November, 1914, between this committee, the electrical committee of the National Fire Protection Association and representatives of the Bureau of Standards. At this conference it appeared to be the general desire of the electrical committee that the Underwriters' Code should not attempt to cover the subject of electrical life hazard, but that a separate safety code be prepared, the two codes being in harmony, but distinct and overlapping as little as possible. This seemed desirable not merely because the National Fire Protection Association, which has charge of the present code, is distinctly a fire-prevention organization, but because the method of administration of the two codes would be different. The Underwriters' organizations could not be expected to enforce life-hazard rules, and public service commissions and industrial commissions could not enforce fire-prevention rules. City-inspection departments would, of course, administer both.

It was therefore understood between the representatives of the Bureau of Standards and the two committees representing the National Fire Protection Association that the responsibility for the fire-prevention code remain as heretofore, with life-hazard rules eliminated as far as practicable (the bureau co-operating with the electrical committee), and that the Bureau of Standards take the chief responsibility in preparing a National Electrical Safety Code, with the electrical committee as one of its co-operating organizations. A complete working agreement was reached, and a joint committee appointed to confer with representatives of the bureau in carrying out the proposal. In accordance with this understanding, this committee met the representatives of the bureau, and together they first went over the present code and noted a series of changes that seemed desirable, which were recommended to the electrical committee and adopted by it at its recent meeting. They then went over the bureau's rough draft of a safety code (not, however, including the operating rules), and later they went over a revised and improved copy, both times making many valuable suggestions.

Conference on the Code

In addition to the above-mentioned conferences in January, February and March with the N. E. L. A. committee, and in December and February with the National Fire Protection Association committee, conferences have been held during the past three months in Washington, Philadelphia, New York, Boston, Schenectady and Cleveland with groups of persons representing many different interests, including state commissions and operating and manufacturing companies.

In the discussion of the rules on generating and substations and transmission and distribution lines we have been especially assisted by our two conferences in Philadelphia with a large committee of the Pennsylvania Electrical Association; by three conferences in Washington and New York with representatives of several engineering societies, including Mr. Farley Osgood, chairman of the national joint committee on overhead-line construction; by our three-day conference in Boston with representatives of the Edison Electric Illuminating Company of Boston, the two electric railway companies, the Tenney Company and the telephone company; by our conference in Schenectady with a number of the engineers of the General Electric Company; by our inspections and conference in Cleveland with the representatives of the two lighting companies, and by Mr. S. B. Way, of Milwaukee, representing the Wisconsin Industrial Commission and the Milwaukee Electric Railway & Light Company.

Representatives of state commissions and cities and the fire and casualty companies have been of most service in connection with rules on utilization equipment.

Preliminary Publications

It may appear to some that after so many conferences and so much advice the bureau's representatives should have perfected the code by this time and should now be ready to offer it for adoption and enforcement. But a safety code such as this is more than a collection of wise precepts or a list of well-understood maxims of good practice. It is true that there are many very obvious and well-known things in the code. It is also true that it has to deal with some things about which there are great differences of opinion, and some about which there is a scarcity of exact information. The code undertakes in some respects to standardize practice and to prescribe safe rules of construction where greater safety often involves greater cost. It will therefore be understood readily that it would be unwise in the extreme for the Bureau of Standards to attempt to formulate rules that are intended to be generally adopted and some of them made mandatory on existing installations without the most thorough study and the fullest possible consultation with the interests affected in all parts of the country. We feel, however, that the period of nearly a year and one-half of preparatory study and the past three months of conferences and revisions and development of the code have given a result which justifies a preliminary publication, such as was given the operating rules last August. We are therefore expecting to put into print very shortly the three sections of the code having to do with construction and send out a large number of copies for discussion and criticism, and give

companies using electrical machinery a chance to test the proposed rules in practice.

Future Conferences

Mr. W. J. Canada, who came into the bureau for the purpose of taking up this work and has devoted himself almost exclusively to it for twenty-one months, had several years' experience in the Rocky Mountain field just before coming to Washington, and Mr. H. S. Phelps, who has more recently been appointed, is also from the same region. Both had previously been in the East, and both had experience with operating and with manufacturing companies. Mr. F. W. Glading has also had a long experience of a similar character. We have, of course, had much correspondence with Western companies as well as conferences with engineers representing Western companies. We do not, however, feel that we have as yet conferred with the West and South as much as we ought, and hence are planning to have representatives of the bureau go through the South and West to the Pacific Coast during the next two months and hold a large number of informal conferences with the engineers of companies and with state commissions and city inspectors, and gather information and the results of experience that will be useful in preparing a revision of the rules as they appear in the preliminary publication. We shall also expect to receive a great many carefully worded criticisms by letter, if our experience with the first edition of the operating rules is repeated. All this information and criticism will be utilized early in a thorough revision of the rules, and then will be submitted to a conference in Washington July 1 and 2 for consideration, modification and ratification. We had hoped to have this conference earlier, and we fear some of the state commissions that have been waiting for the completion of the code may be impatient at the delay. But we believe that the importance of the subject justifies the time and effort for a thorough piece of work, and that all interests affected will be better satisfied and served if we make haste slowly.

In Philadelphia we met representatives of the Philadelphia Electric Company, the Philadelphia Rapid Transit Company, the United Gas Improvement Company and utilities of Pittsburgh, Williamsport and other places. The first conference was at the suggestion of the chief engineer of the Pennsylvania Public Service Commission, who was present. At the second conference the electrical engineer of the Pennsylvania Industrial Commission was present. When the section of the rules on stations was read and discussed we had present, besides those who sat through the entire conference, engineers who were experts on power generation and station operation; when we discussed the rules on overhead lines and underground distribution we had experts in those subjects. On both occasions the discussion continued through three sessions until midnight, and every rule was read and scrutinized and many rules were amended.

Similarly, at conferences in Boston, New York and Washington the rules were read and minutely analyzed, and in some cases radically amended. Rules that emerge from the fiery furnace of that kind of criticism cannot be very far wrong, especially if, as in this instance, the conferees represent large and small operating companies (electric power, railway and telephones), manufacturers, state commissions, city inspection departments, fire and casualty insurance interests, and the federal government.

The Support of Public Opinion

It goes without saying that in order that the safety code shall be a success it must be supported by the best opinion of the electrical interests. State commissions and city officials cannot successfully enforce a code that does not justify itself from the standpoint of the engineer as well as from the standpoint of the public official. The Bureau of Standards would not consent to write into the code as mandatory rules anything which would be an unfair requirement upon operating and industrial companies. At the same time it is true that there is considerable difference of opinion among engineers and managers as to what is reasonable and what is a hardship. The conferences and discussions we have held have undoubtedly been of educational value not only to the representatives of the bureau, but also to the representatives of the operating companies. One object of the conference to be held in Washington in July is to bring together men of varying interests and opinions, and discuss whatever points remain upon which an important difference of opinion exists. Such discussion often brings about agreement where it could not otherwise be expected. Although the bureau has undertaken the responsibility of the preparation of the code, and reserves the right in the revision to omit or amend as seems necessary, it will be guided in this matter by the consensus of opinion at the final conference.

After the code has been completed and published it will be necessary to follow it up, gathering information and experience with which to revise it at the end of one year and thereafter perhaps every two years. The Bureau of Standards expects to keep the engineers who have been engaged in the preparation of the code upon the work of its development. They will confer with state commissions, city inspectors, operating companies, manufacturers of electrical machinery, instruments and supplies, and committees of engineering societies, and the bureau will be able to serve as a clearing house of information regarding the safety code and its administration.

A Permanent Joint Committee

In order to make this work as satisfactory and successful as may be, and to get the best advice possible in the interpretation and necessary amendment of the code, we propose to ask the July conference to approve the appointment of a permanent joint committee to co-operate with and advise the bureau, and to discuss and approve amendments to the code. The bureau will suggest a committee of forty-eight members, possibly made up somewhat as follows: twelve representatives of state industrial and public service commissions; six representatives of the inspection departments of cities; three representatives of the International Association of Municipal Electricians; three representatives of the International Brotherhood of Electrical Workers; three representatives of the American Institute of Electrical Engineers; three representatives of the N. E. L. A.; three representatives of the American Electric Railway Association; three representatives of the telephone interests; three representatives of the National Fire Protection Association; three representatives of the Workmen's Compensation Service Bureau and the casualty insurance interests; three representatives of the National Safety Council; three representatives of the National Bureau of Standards.

A sub-committee of sixteen members would represent every separate interest, and it could meet oftener than the main committee, which would perhaps assemble usually only once a year.

The various organizations mentioned above will be asked to appoint delegates to the July conference, and, if the idea of a permanent joint committee is approved by that conference, it may be established very soon, and take up the consideration of the final revision of the code before its formal publication this summer.

Something about the code itself will be said in the second part of this article in a later issue.

A New Printing Telegraph System

Detailed Description of the Apparatus Recently Developed for the Western Union Company Using the Typewriter-Printing Principle

BY PAUL M. RAINEY

SEVERAL years ago the Western Union Telegraph Company found that in order to take care of its rapidly increasing business it would be necessary greatly to increase the facilities. Two methods were available—first, more economical methods of utilizing the present wire facilities; second, installation of additional wire facilities. The former was undoubtedly preferable, if practically possible. A careful study was made of all that had been accomplished in the direction of high-speed telegraphy, and a thorough investigation of the problem was instituted, the result of which was the decision to develop a system best suited to meet the requirements of the service. At that time it appeared that use should be made of a machine-sending and page-printing system employing an equal-letter five-unit code. Upon reaching this conclusion, the Western Union Telegraph Company called on the Western Electric Company to co-operate in the development with a view to designing and manufacturing the apparatus finally decided upon. The Western Electric Company, which is the largest manufacturer of telephone and telegraph instruments in the world, had already developed what appeared to be a very satisfactory page-printing telegraph machine for use over short lines. The combined effort and experience of the engineers of these two companies has resulted in the development of a thoroughly practical and flexible printing telegraph system, well suited to meet the operating and traffic requirements of large operating companies, and also well suited to render service in other lines of business activity.

FIG. 1—DIRECT TRANSMITTING KEYBOARD

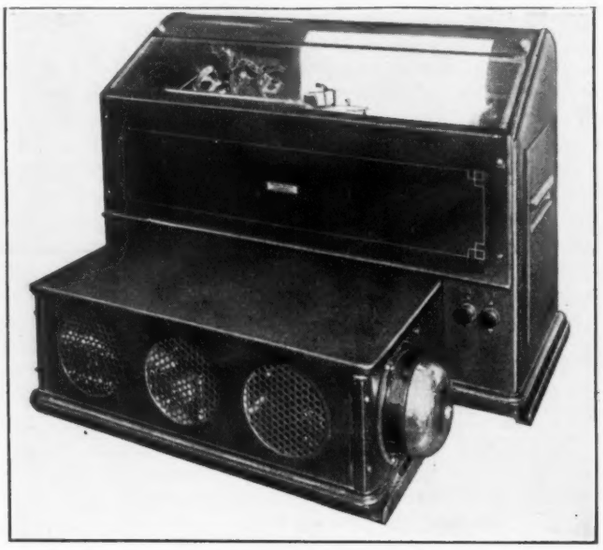


FIG. 2—PRINTING RECEIVER

As compared with other printing telegraph systems, this system appears to be the best and most comprehensive yet produced. Its predominating features are its breadth of scope, flexibility in operation, traffic-carrying capacity, accuracy of operation, efficiency of labor, and economy in cost of maintenance. The system is suitable for operation over open wire, underground or submarine cable of any length over which a line relay can be operated satisfactorily. Its flexibility permits of a large number of methods of operation, the one to be employed in a given case depending upon the operating and traffic conditions imposed.

Methods of Operation

In this article endeavor has been made to give a general description of the system at large, some methods of operation, and a description of the various pieces of apparatus which are used throughout the system. Some of the various methods of operation which have been standardized are as follows:

1. *One-Way Method of Operation.*—This method provides one traffic channel which may be used in either direction. The capacity of a line operated by this method is roughly forty-five words per minute in either direction. This system is intended for short-haul traffic and is intended for use over lines comparatively free from inductive disturbance and not exceeding the equivalent of 30 miles of underground cable.

2. *Two-Way Method of Operation.*—This method of operation provides one traffic channel in each direction simultaneously without involving the use of duplex balancing apparatus. Its traffic-carrying capacity is equal to, roughly, forty-five words per minute in each direction, or a total of ninety words per minute for the line. This system is operative over any length of line not requiring the use of repeaters. For economic reasons it would ordinarily not be used for lines longer than 500 miles.

3. *Double-Duplex Method of Operation.*—This method of operation provides two traffic channels in each direction. Simultaneous transmission in each direction is obtained by means of the duplex balance. The traffic-carrying capacity of the circuit, is, roughly, forty-five words per minute per channel, ninety words per minute in each direction, and a total for the line of 180 words per minute.

4. *Triple-Duplex Method of Operation.*—This meth-

od of operation provides three channels in each direction, simultaneous transmission in two directions being obtained by means of the duplex balance. The traffic-carrying capacity is, roughly, forty-five words per channel, 135 words per minute in each direction, or a total of 270 words per minute for the line.

5. *Quadruple-Duplex Method of Operation.*—This method of operation provides four channels in each direction, the simultaneous transmission in two directions being obtained by means of the duplex balance. The traffic-carrying capacity is, roughly, forty-five words per channel, 180 words in each direction, or a total of 360 words per minute for the line.

The methods of operation described above by no means represent the limit of flexibility of the system, for if line conditions will permit, the number of channels may be further increased. Moreover, it should be understood that the working speed per channel is not limited by the apparatus, but rather by economical operating conditions. Forty-five words per minute is thought to be an economical working speed. Satisfactory operation of the apparatus has been had at

Ordinarily, for one-way service, keyboard transmission is adopted, instead of tape transmission. In either case the home printer may or may not be used to provide a record of all traffic passing over the circuit. However, when desired, use may be made of tape transmission for this class of service, which possesses the advantage of affording a simple and efficient storage of signals, thus keeping the speed of transmission constant. This is of particular advantage in operating over a difficult circuit; for example, a line which would easily permit of a fair average speed, but which would not be capable of transmitting the signals at the maximum speed of the operator.

The Alphabet Used

In any printing telegraph system the question of alphabet or code used is one of prime importance. The code used in this system is an equal-letter five-unit code; that is, each signal consists of five units or current impulses, and all signals require the same amount of line time for their transmission. This is true if the signal is that of a letter, a figure, or a signal which

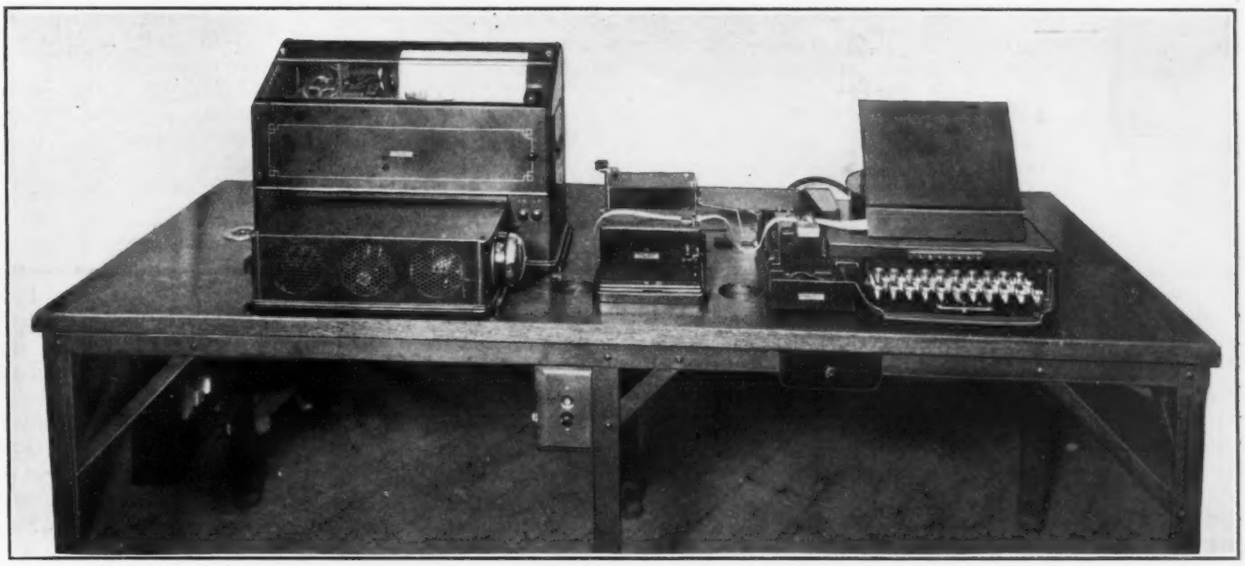


FIG. 3—COMPLETE TRANSMITTING AND PERFORATING EQUIPMENT

fifty-two words per minute per channel on a quadruple duplex, thus making a total of 416 words per minute for the line.

In the case of the quadruple-duplex, triple-duplex, double-duplex and two-way services, the messages are first prepared on tape by an operator using a keyboard perforator, as shown in Fig. 13. When each key of the perforator is depressed, several holes are punched in the tape, and their arrangement determines the combination of positive and negative currents which will be sent to line when the tape is fed through a transmitter (Fig. 16) working in conjunction with a distributer (Fig. 10). The impulses thus transmitted over the line operate a polarized line relay at the receiving station, which, in conjunction with another distributer, passes the impulses along to a receiving printer (Fig. 2), which translates them into the predetermined letter or figure and prints them in column form (Fig. 19), so that when a message is completed it may be torn off and is ready for delivery. If so desired, the message may also be received in the form of a perforated tape. This is accomplished by means of a re-perforator which works in conjunction with the printer. The tape thus prepared may be used for retransmission on another line operated by any of the methods described above.

is utilized to perform some other function at the receiving end. This type of code is generally known as the Baudot code, because of its use in the Baudot system, which has been extensively used throughout Europe, particularly in France, for upward of thirty years. Referring to Fig. 4, it will be noted that all of the signals are shown of equal length and that each consists of five units. Considering the black above the dotted line as positive and below the dotted line as negative, it is seen that the letter "A" consists of units 1 and 2 positive and units 3, 4, and 5 negative, that letter "B" consists of unit 1 positive, units 2 and 3 negative and units 4 and 5 positive, and letter "C" consists of unit 1 negative, units 2, 3 and 4 positive and unit 5 negative, and so on. In a five-unit code, assuming that each unit is represented by a pulse of positive or negative current, there are available thirty-one combinations which are sufficient for all the letters of the alphabet and the functions—carriage return, line feed, letter shift, figure shift, and space. The various figures and additional functions are obtained by means of another case, as is indicated. Thus the signals for "A," "B," "C," etc., can be made to print "-," "?," ":," etc., by preceding these signals by the figure-shift signal. Before returning to letters, it will then be necessary to send the letter-shift signal, which will

cause the printer to proceed in the lower case. As just pointed out, it is necessary to employ signals for figure shift and letter shift in order to obtain all the letters, figures and symbols required. In addition to this, the column printing feature requires signals to lift the paper vertically and return the carriage for a new line. The transmission of these extra signals over the line oc-

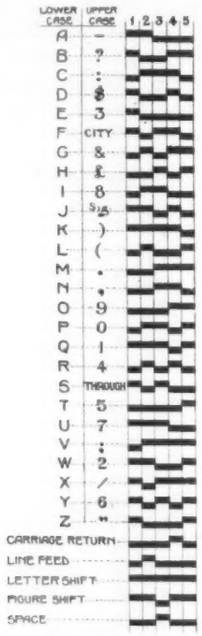


FIG. 4—BAUDOT SIGNAL CODE

cupies line time, and this loss of time has been found to average about 10 per cent of the working time, for ordinary telegraph traffic. In other words, the code employed in this system may be considered to average 5.5 units per character so far as line transmission is concerned. Analyzing the Continental Morse code as used in Wheatstone working on the same basis, it is found that signals for the various letters and figures occupy different lengths of line time. An investigation of actual telegrams shows that the Continental Morse code requires an average of 9.08 units per letter. As regards the economy of line time, the five-unit code has an advantage over the Continental Morse code as 5.5 is to 9.08. This means that if the maximum speed of transmission over a telegraph line is 6000 units or impulses per minute, these impulses may form 660 letters in the Morse code and 1090 letters in the five-unit code used in this system, an advantage for the latter in line transmission economy of 65 per cent. On long aerial lines and on lines which consist wholly or partially of underground cable conductors, the advantage to be derived from the use of the five-unit code is considerable. On short lines where the permissible line speed is well beyond that of the apparatus or the requirements of the traffic the shorter code will permit of duplex operation with a greater inaccuracy in the duplex balance. This means that the system can be worked duplex under less favorable weather conditions, with less supervision, than could a system using a code less economical of line time. Fig. 5 illustrates the economy of the five-unit code as compared with the Continental Morse code used with the Wheatstone system. In the upper line are shown the current impulses necessary to send the words "London, New York, Paris," by the Continental Morse. In the lower line are shown the current impulses required to send the same words with the five-unit code. Whereas the Continental Morse requires 192 units of line time to transmit these three words, the five-unit code requires only 100. This, however, is an isolated case, and does not give a true comparison of

FIG. 6—MULTIPLEX OPERATION

the transmission economies of the two codes when used for ordinary telegraph traffic. This is particularly true since the transmission of these words requires none of the special function signals, such as figure shift, letter shift, carriage return, paper lift, etc.

Multiplex Principle

The equal-letter code just described permits of the use of the multiplex principle, which is employed in the quadruple-duplex, triple-duplex, double-duplex and two-way methods of operation. For the sake of explanation, the quadruple duplex can be considered as an example of the multiplex idea. The illustration can be further simplified by omitting the duplex feature, thus affording four channels working in one direction. Fig. 6 shows diagrammatically the method employed to secure multiplex operation. If each of two metal rings, one at each station, X and Y, is divided into four quadrants, A, B, C and D, at Station Y, and A', B', C' and D' at Station X, and rotating brushes E and E_1 are connected to the line as indicated, and if the contact brushes start from the same relative position and sweep over the contact segments with the same uniform angular velocity, quadrant A will be connected through the line with quadrant A', quadrant B with quadrant B', quadrant C with quadrant C' and quadrant D with quadrant D', once per revolution, the interval of each of these four connections being equal to the time of one-quarter of a revolution of the rotating brushes. If each signal consisted of one pulse of current, it would then be possible to send one signal per quadrant per revolution. If, instead of having solid quadrants, each is divided into five segments, it will be possible to use

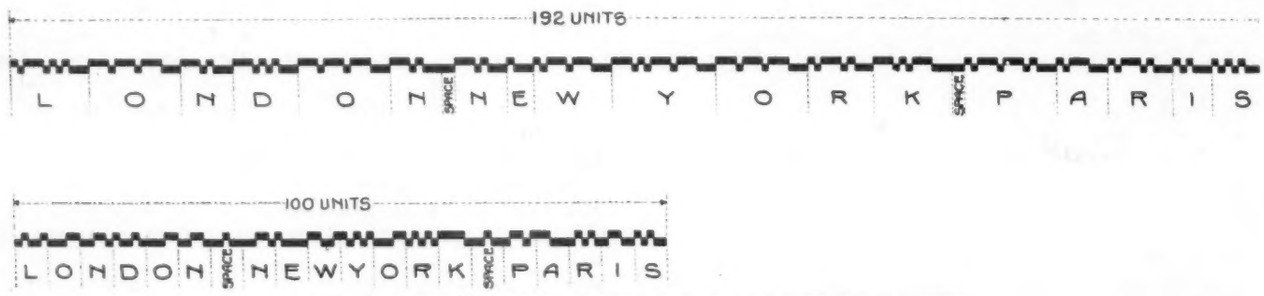


FIG. 5—COMPARISON OF CONTINENTAL AND FIVE-UNIT CODES

the five segments of one quadrant at one end for the transmission of five current impulses, which constitute the signal for a given letter or figure in the code just described, and the five segments at the other end may be used for receiving these impulses and distributing them in such a manner that they may be used to select the letter determined by the combination

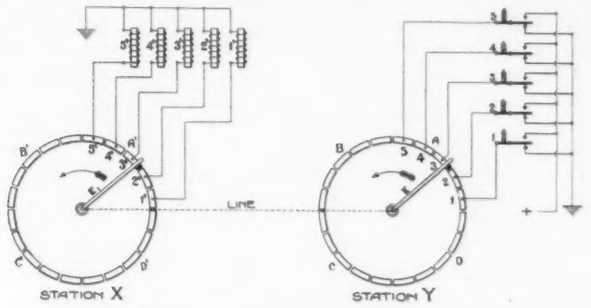


FIG. 7—ARRANGEMENT OF FIVE-PART QUADRANTS

of impulses. In Fig. 7 the quadrants are shown thus divided, each quarter of the circumference consisting of five segments, each segment of quadrant A, station Y, being connected to a contact lever so arranged as to connect this particular segment with the ground circuit or battery, depending upon its position between the fixed contacts, while the segments of quadrant A' at station X are connected to the relays as shown. Normally all of the levers 1, 2, 3, 4 and 5 are in engagement with contacts connected to ground. If, now, any lever is moved over to engage its battery contact during the quarter of a revolution in which the rotating brush E moves over the quadrant A, a current impulse will be transmitted to the line through the rotating brush E, and since the rotating brush E_1 is synchronously wiping over the segments 1′, 2′, 3′, 4′ and 5′ at the same time that the rotating brush E wipes over its contacts 1 to 5, the corresponding relay at station X will be momentarily energized. Thus, if levers 1 and 3 are moved over against their battery contacts while the rotating brush E at station Y wipes over the contacts of quadrant A, relays 1′ and 3′ at station X will receive current impulses, and if all the levers 1, 2, 3, 4 and 5 are held over against their battery contacts, all the relays

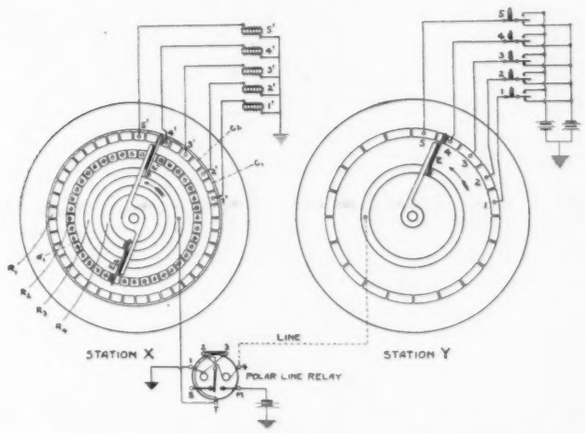


FIG. 8—CONNECTIONS TO SYNCHRONIZERS

1′, 2′, 3′, 4′ and 5′ would receive impulses. Now, if provisions can be made to change the combination of levers during the time that the brush sweeps over the other three quadrants, it will be seen that during each revolution a different signal can be sent from quadrant A to quadrant A'. What has been said regarding quadrants A and A' applies equally to the other quadrants. Thus it will be seen that the multiplex principle permits us to send and receive four character signals per revolution. As will be explained later, in actual operation the functions of the levers at the sending end, station Y, will be performed by the transmitter, and it will be explained that the operation of the five relays 1′, 2′, 3′, 4′ and 5′ is utilized in the printer to select the predetermined letter or figure. It will also be understood that by dividing the ring into a different number of segments it might be possible to send and receive a greater or lesser number of signals per revolution; that is, if ten segments were used, two signals each, consisting of five impulses, could be transmitted and received per revolution, or if thirty segments were used, six signals each, consisting of five unit impulses, could be transmitted and received. The exact method employed for setting up the various combinations of impulses at the sending end, and for receiving and utilizing these current combinations in order to select the proper letters to be printed at the receiving end of the line, will be explained later. What has been described above constitutes multiplex operation. If the line is worked duplex, the same can be accomplished in both directions at the same time, and we then have described the fundamental operation of a quadruple duplex, a triple duplex and a double duplex.

Synchronism

From what has already been stated it will be understood that an essential requirement of such a system

FIG. 9—DISTORTION OF SIGNALS

is that the rotating contact brushes at the two ends shall maintain practically the same phase relation with respect to each other; that is, the two sets of brushes must be made to rotate in synchronism. One will readily appreciate the impracticability of attempting to provide two motors of any type which of themselves will produce rotation sufficiently uniform to meet these requirements. The apparent solution of the problem is to provide means for correcting the phase relation at frequent intervals. Some thirty years ago Baudot accomplished the result by using weight-driven motors with sensitive governors to maintain a nearly constant rate of rotation. One motor was adjusted to run slightly faster than the other, and means were provided for correcting the phase of the brushes at the fast end once per revolution if correction was required. This was accomplished by mechanically stepping back the brushes whenever they had gained an appreciable amount on the brushes at the slow end. The practicability of this method has been demonstrated by the extensive use of the Baudot system in Europe. On the other hand, this method is wasteful of line time, since it is necessary to transmit a special signal once per revolution. Moreover, the type of motor used by Baudot does not permit of readily changing the speed and is one in which the speed depends on a number of variable factors. It will be seen then that the ideal system is one in which no extra time is required for maintaining synchronism, one which will permit of quickly and conveniently changing the speed of rotation of the brushes, and one in which the constancy of speed of rotation does not depend upon a number of variable factors. This has been accomplished in the system herein described, the means employed being briefly as follows:

Referring to Fig. 8, it will be noted that segments 1 to 5 at station Y are connected to levers 1, 2, 3, 4 and 5, so arranged that they may send to the line positive or negative current, depending upon their position. The brush E connects these segments consecutively with the solid ring which is connected to the line. At station X the line is connected to ground through the

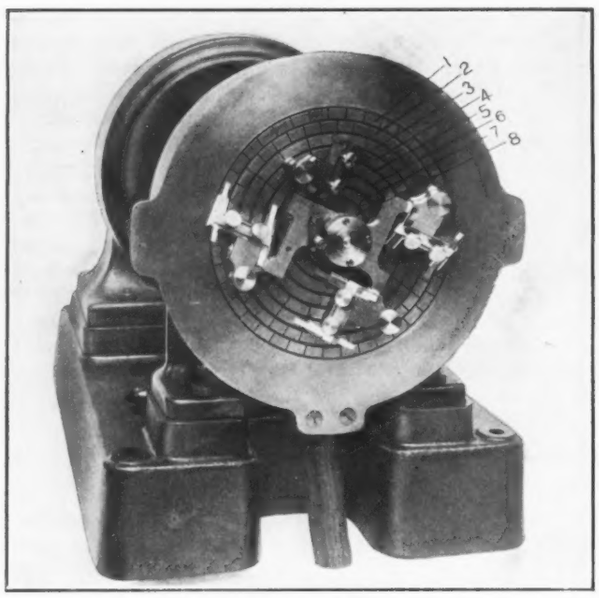


FIG. 10—DISTRIBUTER

windings 1, 2, 3, and 4 of a polarized relay. The tongue T of this relay is connected to the solid receiving ring R_3. The marking contact M of this relay is connected to a grounded battery, and when negative current from the distant end is passing through the relay the tongue rests on the spacing contact S. As the brush E rotates it connects the solid receiving ring R_3 with the receiving segments 1′, 2′, 3′, 4′ and 5′ of R_1 consecutively. It will be noted here that the receiving segments are made shorter than the sending segments, so that the receiving brush E_1 picks out only the center portion of each current impulse, or of each repeated current impulse, since the signals sent over the line are repeated by means of the polarized relay. Assuming perfect synchronism between the sending brush E and the receiving brush E_1, the receiving brush should be at the point C_1 midway between receiving segments 1′ and 2′ when the sending brush passes from segment 1 to segment 2, and at C_2 midway between receiving segments 2′ and 3′ when the sending brush passes from segment 2 to segment 3, and so on. Thus it will be seen that for a change of polarity, which can take place only when brush E passes from one segment to another, the receiving brush E_1 should be at some point in the circumference midway between two receiving segments. In other words, reversals of the line current should take place while the receiving brush is passing between the receiving segments. The receiving distributer is therefore provided with additional rings R_2 and R_4, called correcting rings. R_4 is a solid ring connected consecutively to the segments in R_2 by the brush E_2. These segments are half the length of the sending segments and are therefore double in number. They are connected into two groups—a and b, as indicated. The brushes are so arranged that when the receiving brush E_1 is midway between any two receiving segments, say at O_1, the correcting brush E_2 is just about to engage one of the a segments, say at d_1. Circuit provisions are made so that a short pulse of current is generated locally at each reversal of the line current. When this reversal finds the correcting brush E_2 on an a segment it causes the operation of a mechanism which automatically sets back both brushes E_1 and E_2. Now, if the motor driving the receiving distributer is arranged to run slightly faster than the motor driving the sending distributer, the tendency will be for brushes E_1 and E_2 to be gaining, and the intermittent stepping back, as already described, will result in maintaining the receiving brush E_1 in the proper phase with the sending brush E at the other end of the line. It will thus be seen that at each reversal of the line current the position of the correcting brush on the segmented correcting ring determines whether a correction of phase relation shall be made. Since the motor at the receiving end is running faster than the one at the sending end, sooner or later it will engage an a segment at the time of a current reversal. This causes the brushes to be stepped back through a small angle, so that the current reversals take place only while the correcting brush is on b segments. Thus the signaling impulses are made to provide correcting impulses, which are used to maintain synchronism.

The shortening of the receiving segments to one-half the length of the sending segments provides an ample angle for this purpose. It also possesses the advantage that only the center portion of the signal is utilized for signaling purposes, and the system is less subject to the effect of inductive disturbances. Diagram A, Fig. 9, shows the form of signals sent to the line by the distributer. When the signals are received at the distant end, they are more or less distorted. Diagram B, Fig. 9, illustrates this distortion. It is near the point of reversal at the time the line current is weak that inductive disturbances are able to affect or further distort the signals. If any advantage were to be gained, the segments could be shortened still further, since the relays operated from them are connected in local circuit and require a very short impulse for their operation. It will be appreciated then that the shortening of the receiving segments is not a sacrifice

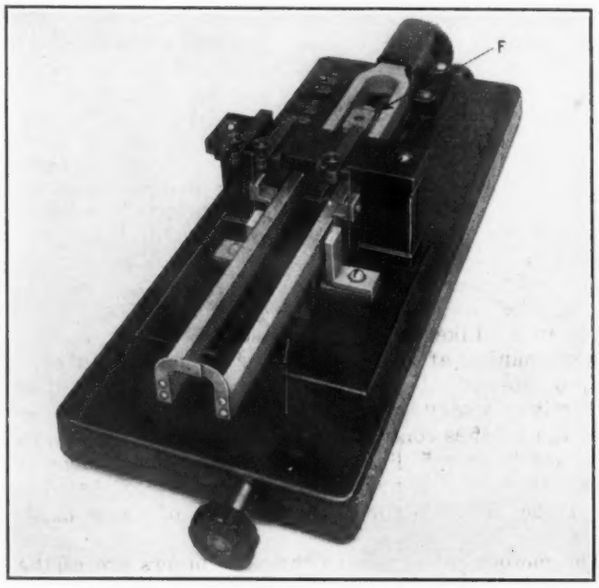


FIG. 11—ELECTRICALLY DRIVEN TUNING FORK

in any sense of the word. In actual practice the line is worked duplex and the sending and receiving distributers are combined and run by one motor, means for maintaining synchronism being used at only one end.

Fig. 10 shows the distributer face with the brushes. It will be noted that this is somewhat more complex

than the diagrams which have been explained. The outside ring, No. 1, of this distributer is the receiving ring, only alternate segments being used for selecting purposes. The intermediate segments in each quadrant, however, are used for a specific signaling purpose, as will be described later under the heading "Printer." The second ring from the outside, No. 2, is the correct-

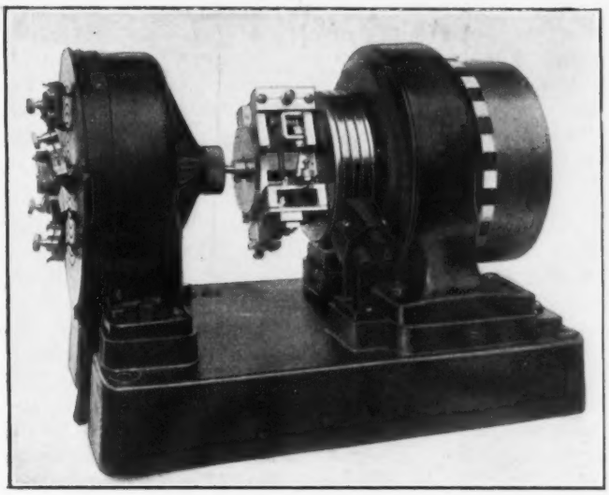


FIG. 12—DISTRIBUTER AND CORRECTOR

ing ring and corresponds to ring R_2 of Fig. 8. The third ring, No. 3, is the sending ring and corresponds to the sending ring at station *Y*, Fig. 5. The fourth ring, No. 4, is called the local ring and performs a very important function, which will be understood from what follows. Referring back to Fig. 7, it will be remembered that while the brush is traveling over quadrants *B*, *C* and *D*, the combination of the levers 1, 2, 3, 4 and 5 should be changed to the combination of the next letter. Likewise, while the brush travels over quadrants *C*, *D* and *A*, the transmitting apparatus connected to quadrant *B* should change its combination to the signal of the next letter, and so on. At station *X* the printer connected to quadrant *A'* receives a letter during one-fourth of the revolution, while the brush E_1 is passing over the segments of quadrant *A'*; but while the brush is passing over the remaining quadrants, *B'*, *C'* and *D'*, the printer has time to complete its printing operation, move the paper and clear out, so as to be in readiness to receive another signal. The segments in this local ring, No. 4, are used to perform these functions; that is, certain segments are used to change the signal combinations set up in the different quadrants. Likewise they are used to start the printing mechanism after selection has been made, so that it may be able to complete the printing operation in time to receive the signal for another letter. It will be noted that the brushes connect these various segmented rings with solid rings 5, 6, 7 and 8. Each brush holder is insulated from the spider, and the individual brushes are made up of a number of strands of small hard-copper wires.

The motors used to drive the distributers are of the well-known phonic wheel type and are driven by impulses from an electrically driven tuning fork. This assures a constant rate of vibration, since the frequency of a tuning fork varies by only about 0.01 per cent per degree centigrade and is little affected by changes in the voltage applied to the driving magnet. Fig. 11 shows the fork used, while the motor distributer and mechanical corrector are shown in Fig. 12. The mechanical corrector, which is shown mounted between the distributer and the motor, is the mechanism which is arranged to step back mechanically the brushes when they have advanced too far, as already explained. The speed of the motor is determined by the rate of vibration of the fork. Large changes in the rate of vibration of the fork are accomplished by adding weights to the two prongs, a set of weights being provided with each fork. Small changes in the speed of the motor (a fraction of a revolution per minute) are obtained by turning the handle at the front of the fork, which, by means of gears and a screw, moves the small fork *F* forward or backward. The shutters on the ends of the prongs are used for stroboscopic observation and are not essentially a part of the system.

Perforator

Fig. 13 shows the perforator. This apparatus is provided with a keyboard similar to that of a standard typewriter. The stroke of the keys is short, so that it can be operated without fatigue. Fig. 14 shows the interior of the apparatus. The selecting mechanism consists of five horizontal bars placed beneath the keys and so arranged that each key, when depressed, will engage one or more of the various bars and depress them by the movement of the key. The depression of these bars selects the punches in the punch-head. After the selection of the punches is made, a common contact is closed which operates the perforating magnet. The tape is perforated crosswise instead of lengthwise, thereby effecting a considerable saving in the amount of tape. This is illustrated by Fig. 15, in which *A* represents the piece of tape required for transmitting the words "London, New York, Paris." One-half the tape shown in *B* is the tape required to send the same words by the Wheatstone. The two pieces shown in *B* represent the amount of paper used by a printing telegraph system which utilizes the Continental Morse code. One tape is required for transmission, and the other is prepared by a receiving perforator and is then fed into a printing machine, which translates it and prints it on a tape. From this it will be appreciated that the economy in tape is a feature of some consideration. Fig. 14 also shows the mechanism of the indicator, the purpose of which is to indicate to the operator the number of let-

FIG. 13—PERFORATOR

ters that have been punched on one line. This is a ratchet mechanism which is operated one tooth for each operation of the punching mechanism, carries a pointer across a graduated scale, and is returned to normal at any time the carriage return key is depressed. A lamp signal is also provided which warns the operator that she is nearing the end of a line. This perforator is

extremely fast and on test has perforated correctly up to a speed of ninety-two words per minute, which was the limiting speed of the operator.

Transmitter

Fig. 16 shows the transmitter with the tape inserted. At each revolution of the distributer the tape is moved

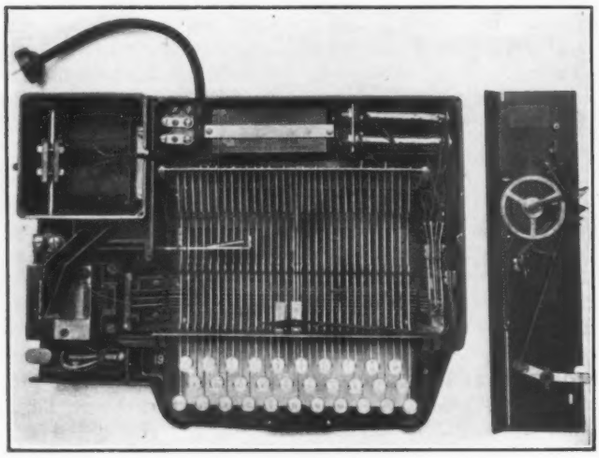


FIG. 14—KEYBOARD MECHANISM

one step to the left. This is accomplished by means of a pulse of current from a segment in the local ring, No. 4, of Fig. 10, as has already been described. The location of this segment is such that the stepping of the tape takes place shortly after the transmission from the fifth segment of the distributer, so that the tape can be moved forward and a new combination set up on the levers before the brush is ready to transmit another signal from this particular quadrant. Five fingers are raised which, if they find holes in the tape, move upward and operate levers which correspond to those shown in Figs. 7 and 8, thus setting up in one quadrant or one group of five segments the necessary combination for a given signal. The transmitter is provided with two switches for control by the operator. The upper switch, which has two positions, "start" and "stop," is used when it is desired to insert a new tape or when it is desired to stop the transmitter. In the "start" position the tape is moved forward one step per revolution, as forward, but the signal which happens to be in the transmitter will be repeated once for each revolution of the distributer, because the operation of this switch does not draw down the fingers which feel out the holes in the tape, as does the operation of the other switch. This is sometimes desirable for testing purposes. Normally, this switch is left in the "on" position. Fig. 17 shows the transmitter with the cover removed and the clips which are provided to make contact with springs mounted on the table. This method is adopted with the various pieces of apparatus, as will be noted later, so that a piece of apparatus can be readily removed, if suspected of being faulty, and replaced by one which is known to be in working order.

Printer

The printer is shown in Fig. 2. In front of the printer proper is a box containing the relays and resistances essential to its operation. A bell is also provided which responds to a predetermined signal sent over the line, this signal being the signal for "J" preceded by a figure shift signal. Alongside of this box on the printer frame are two push-buttons, one marked "CR" and the other "LF." By operating these push-buttons, the operator can return the carriage or cause the paper to be moved upward. This is frequently desirable, particularly in starting up after an interruption, in preparing the printer for a new message. "CR" indicates "carriage return," and "LF" "line feed." The printer and the relay box are two separate units and are connected to the table wiring through spring clips similar to that shown on the transmitter. The relay box is removed by pulling forward, and the printer by sliding backward. The printer is arranged to print the message in column form on paper 8.5 in. wide. Fig. 19 shows the form of message and style of characters. Paper is supplied to the machine from a roll mounted on the back and so arranged that it can be readily replaced by an operator standing in front of the table. Just above the window of the printer is a cutting edge which permits a message to be torn off as soon as completed. The machine is of the type in which the paper moves and the type wheel is stationary, except for its rotary movement, in order to bring the desired letter opposite the paper. The type wheel is mounted on a vertical shaft driven by a spring which is kept under the desired torque by a small motor and dynamometer. The type shaft is released after the

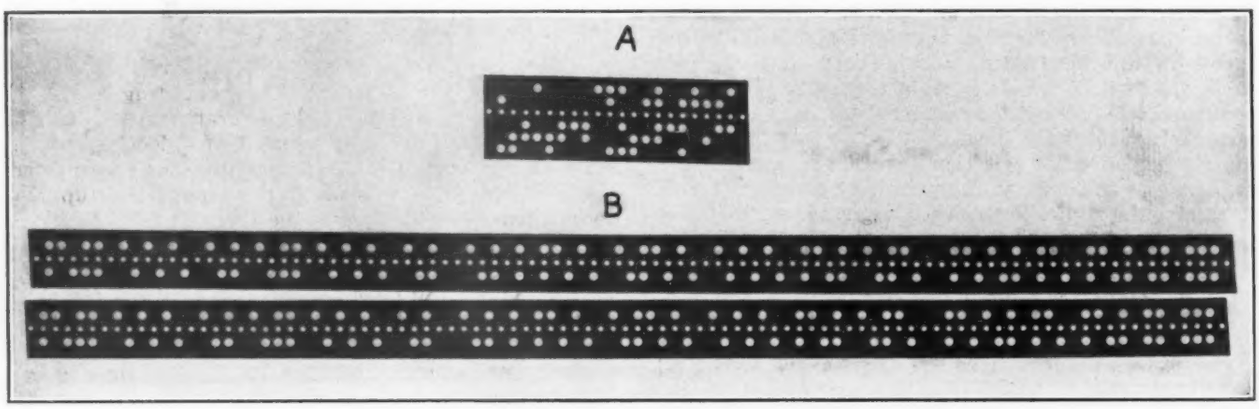


FIG. 15—COMPARISON OF PERFORATED TAPES

described. In the "stop" position the fingers which feel out the holes in the tape are all held down, thus connecting only the spacing battery to the five segments connected to this transmitter. The switch in the base, which has two positions, "on" and "off," opens and closes the circuit of the stepping magnet. If in the "off" position, the tape will therefore not be stepped letter has been selected, and it revolves until it strikes a stop thrown up in its path. The position of the stop is determined by the letter selected and brings the desired letter in front of the paper. As soon as the type wheel is stopped the paper is forced against the type wheel by a printing magnet, and the letter is printed. The wheel is inked by two felt rollers which have been

saturated with ink and which are held against the type wheel. The selection of stops is obtained mechanically by the use of five disks. The position of each disk is determined by an electromagnet which is under control of one of the relays connected to the receiving segments. For each combination of relays selected there is a corresponding movement of the disks which permits the re-

FIG. 16—TAPE-OPERATED TRANSMITTER

quired stop to be moved into such a position as to stop the type wheel in the proper position. Fig. 18 shows the printer and relay box with covers removed. The paper has also been removed, in order to show parts which would otherwise be hidden. The type wheel and ink rollers are shown at 1, the selecting disks at 2, and the motor at 3.

One unique feature in the design of this printer is its unit construction. For example, the mechanism which moves the paper carriage and the paper across in front of the type wheel is a complete unit by itself, and is shown at 4. In case of trouble in this unit it can be replaced in a very few minutes without disturbing the adjustments of the other units which go to make up the printer. The printing unit is shown at 5, and is likewise easily replaced. The paper carriage, 6, is a unit which can be readily removed. Likewise the paper lift, 7. In fact, the working parts of the printer consist of twelve units, each distinct and readily

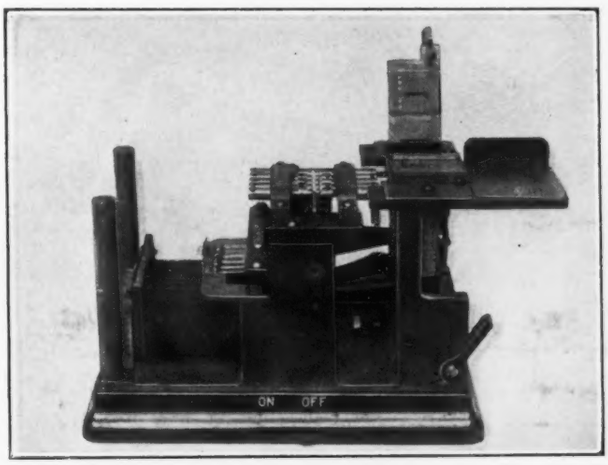


FIG. 17—TRANSMITTER WITH COVER REMOVED

removed. Two lamps are provided for special signals, No. 8 and No. 9. Lamp No. 8 is used in the one-way system when the printer is used in connection with a keyboard, and indicates to the operator that she is nearing the end of the line. Signal lamp No. 9, used in all methods of operation, indicates whether or not signals are coming in to the printer. In all the methods of operation using a distributer, two-way, double-duplex, triple-duplex and quadruple-duplex, this lamp is operated directly from the distributer through the intermediate segments in the receiving ring R_1 (Fig. 8). The flashing of this lamp when the printer is not working indicates that the latter is out of service.

The function of this lamp is to eliminate the possibility of an operator sending messages when the distant printer is not working and the receiving operator assuming that the failure to print is due to the fact that the transmitter at the distant end is not sending. In the relay box the five relays to the left constitute the five selecting relays shown in Figs. 7 and 8. The sixth relay from the left is the one which receives a pulse from a segment in the local ring, No. 4, and starts the mechanism of the printer after the selection has been received by the selecting relays. The remaining seven relays are required to perform various functions, the description of which would lead to considerable detail.

Automatic Control

Fig. 20 shows a piece of apparatus known as the automatic control. The function of this piece of apparatus is to stop the transmitter in case the operator is unable to keep up with the pace set by the distributer.

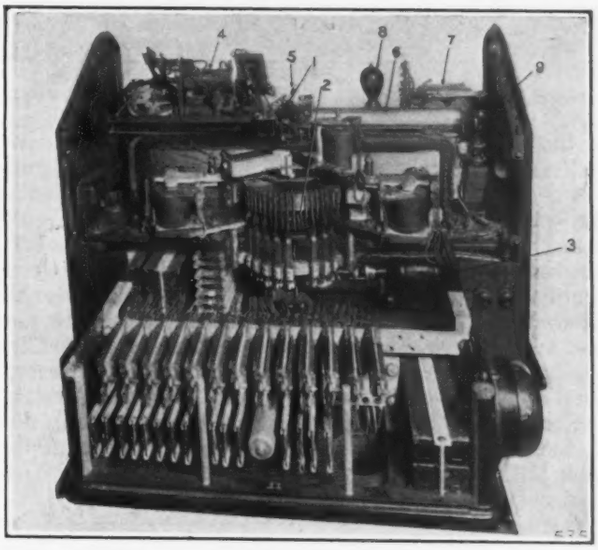


FIG. 18—INTERIOR OF PRINTER AND RELAY

Its position on the printing table is shown in Fig. 3, directly behind the transmitter, the projecting lever arm extended forward between the perforator and the transmitter. The tape normally forms a small loop as shown. If the perforating operator should stop, the transmitter will continue until the slack in the tape is used up and the tension of the tape lifts the lever of the automatic control. This movement automatically stops the transmitter, which, however, continues to transmit only spacing current, having no effect on the distant printer. As soon as the operator begins perforating, the lever arm is dropped and the transmitter continues from the point of the interruption. Thus the message at the distant end is not mutilated. The automatic control has one other important feature, namely, it enables the receiving operator to send bell signals over the line, as has already been referred to. This is accomplished by an escapement mechanism which drives cams, causing certain spring combinations to be made in sequence. For example, to ring the bell once at the distant end the operator will insert a finger in the hole marked "start" and pull down until the finger engages the stop, and then release. In returning to the normal position shown

the cams will be rotated and the required contacts made to give the bell at the distant end one stroke. In doing this the transmitter is automatically stopped and started, thus causing no mutilation of the message which is being transmitted. If it is desired to ring the bell twice at the distant end, indicating to the operator that the tape should be re-run, the operator will insert the finger in the second hole marked "re-run," pull the lever down to the stop and release as before, and so on. Thus signals of one, two, three, four or five strokes of the bell can be automatically transmitted over the line without mutilating the message that is being transmitted. The automatic control is also arranged with the clip connections, so that it can be readily removed. Fig. 21 shows the interior of the apparatus, the cams and contact springs being plainly visible in the foreground.

Fig. 3 shows a complete multiplex table equipment. On the left is the printer with its relay box, in the center are the transmitter and automatic control, and at the right is the keyboard perforator. Beneath the table at the left will be noted a metal terminal box. This box contains fuses, and in it all the connections are made between the table and the distributer. This table is a standard unit for use in the two-way, double-duplex, triple-duplex and quadruple-duplex methods of operation. The number of table units required for the various methods of operation are as follows: Two-way, one at each end; double-duplex, two at each end; triple-duplex, three at each end; quadruple-duplex, four at each end.

In addition to the number of table units required for each method of operation, there will be required at each end an electrically driven tuning fork, a motor, a mechanical corrector, and a distributer having the proper segment arrangement for the particular service required.

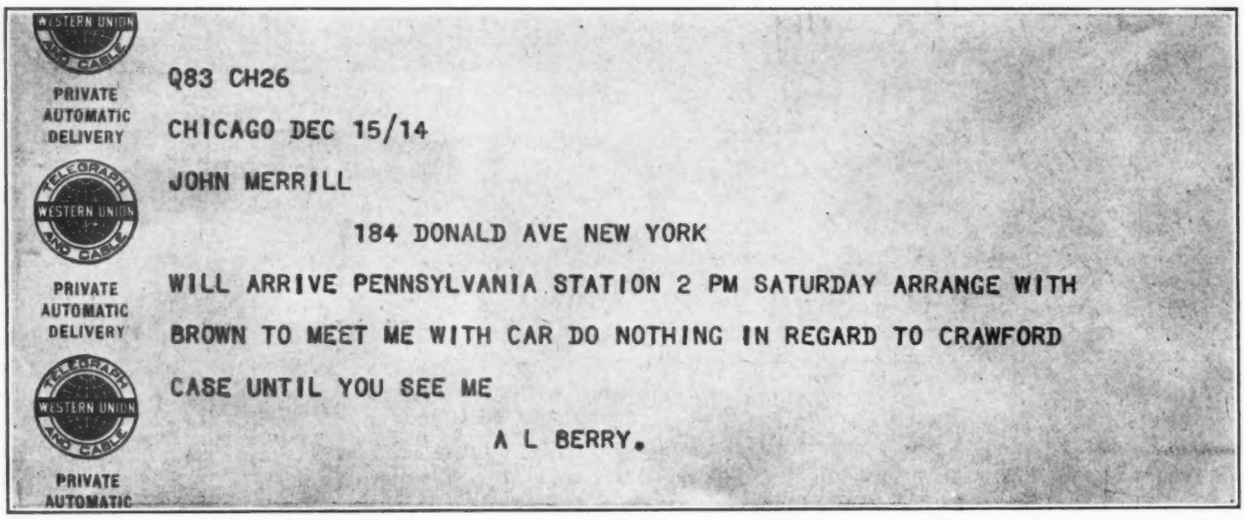

PRIVATE AUTOMATIC DELIVERY
Q83 CH26
CHICAGO DEC 15/14
JOHN MERRILL
184 DONALD AVE NEW YORK
PRIVATE AUTOMATIC DELIVERY
WILL ARRIVE PENNSYLVANIA STATION 2 PM SATURDAY ARRANGE WITH
BROWN TO MEET ME WITH CAR DO NOTHING IN REGARD TO CRAWFORD
CASE UNTIL YOU SEE ME
A L BERRY.
PRIVATE AUTOMATIC

FIG. 19—MESSAGE PRINTED AS RECEIVED

For the one-way service using keyboard transmission the same printer as shown in Figs. 2 and 18, without the relay box, is mounted on a special table with a direct transmitting keyboard, as shown in Fig. 1, this combination sometimes being called the short-line printer. Where the characteristics of the line will permit, the one-way system is capable of satisfactory operation at the highest operator speeds. On more difficult circuits it may be advisable to resort to tape transmission, for reasons already stated. Where this method of operation is used as a feeder or distributer for one of the other methods of operation, it may be advisable to use tape transmission at the central-office end, since then it will be possible to utilize tape produced by a re-perforator for transmission purposes. In this case it is not essential to have the printer at the central office record outgoing messages, since the tape may constitute an office record.

Figs. 22 and 23 afford a forcible illustration of the flexibility of the system. In these illustrations T_1, T_2, T_3, etc., represent tape transmitters, each of which is

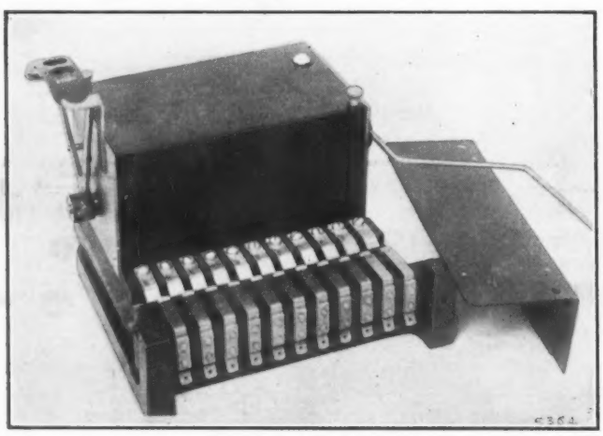


FIG. 20—AUTOMATIC CONTROLLER

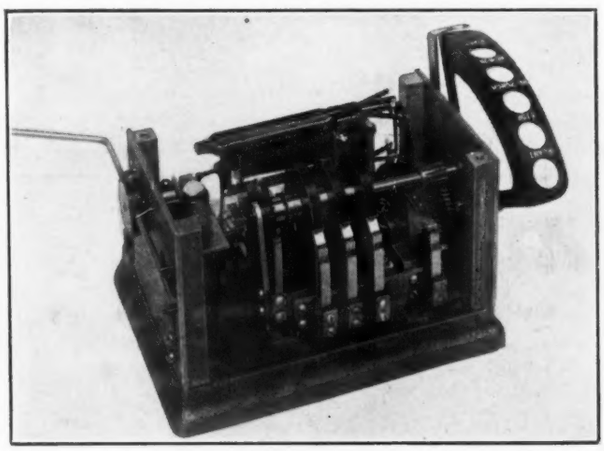


FIG. 21—INTERIOR OF AUTOMATIC CONTROLLER

fed with tape from a keyboard perforator, and P_1, P_2, P_3, etc., represent receiving printers or, if desired, re-perforators. In any case it is understood that a message sent on transmitter T_1 is received on printer P_1, that messages sent on transmitter T_2 are received on printer P_2, and so on. For example, in diagram 1 of Fig. 22 is shown a system working between cities *A*, *B* and *C*.

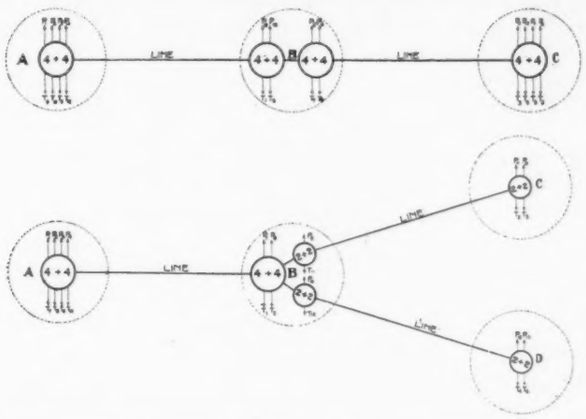


FIG. 22—INTERCONNECTIONS BETWEEN THREE CITIES AND BETWEEN FOUR CITIES

The line transmission between *A* and *B* is a quadruple duplex; likewise that between *B* and *C*. The following channels are available, each capable of carrying traffic at roughly forty-five words per minute: Between *A* and *B*, four channels, two in each direction; between *A* and *C*, four channels, two in each direction; between *B* and *C*, four channels, two in each direction.

In diagram 2 of Fig. 22 is shown a modification in

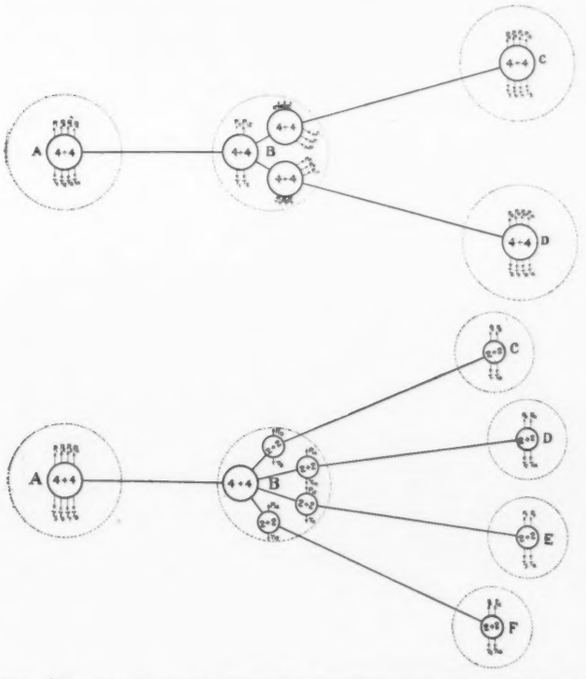


FIG. 23—INTERCONNECTIONS BETWEEN FOUR CITIES AND BETWEEN SIX CITIES

which the cities *A* and *B* are connected by a quadruple duplex, *B* and *C* by a double duplex, and *B* and *D* by a double duplex. This system affords the following channels: Between *A* and *B*, four channels, two in each direction; between *A* and *C*, two channels, one in each direction; between *A* and *D*, two channels, one in each direction; between *B* and *C*, two channels, one in each direction; between *B* and *D*, two channels, one in each direction.

In diagram 1 of Fig. 23 is shown a system connecting four cities, *A*, *B*, *C* and *D*, which affords the following channels of communication: Between *A* and *B*, four channels, two in each direction; between *A* and *C*, two channels, one in each direction; between *A* and *D*, two channels, one in each direction; between *B* and *C*, six channels, three in each direction; between *B* and *D*, six channels, three in each direction.

Diagram 2 of Fig. 23 shows a modification of the system connecting cities *A*, *B*, *C*, *D*, *E* and *F*. This arrangement affords the following channels for traffic: Between *A* and *C*, two channels, one in each direction; between *A* and *D*, two channels, one in each direction; between *A* and *E*, two channels, one in each direction; between *A* and *F*, two channels, one in each direction; between *B* and *C*, two channels, one in each direction; between *B* and *D*, two channels, one in each direction; between *B* and *E*, two channels, one in each direction; between *B* and *F*, two channels, one in each direction.

Whether or not any of these modifications will ever be installed exactly as described is problematical, but they are all possible and serve to show the inherent flexibility of the system. The practicability of the system has been proved by tests of the quadruple duplex by the Western Union Telegraph Company. This equipment has been in operation for more than a year. The results of this and other less extended tests indicate that the system is thoroughly practical and is well past the experimental stage.

Applicability of System to New Fields

The extreme flexibility and comparative simplicity of this system permit it to touch entirely new fields. For example, the one-way method of operation will doubtless find a field in mercantile establishments for intercommunication between factory and offices, etc. Having a number of printers operated from one keyboard is well suited for distributing orders and information to a number of departments. Modifications of the system are particularly well adapted for news distribution service. In fact, it is difficult to conceive of lines of business activity in which some modification of the system cannot render valuable service.

The successful development of this system has resulted from the solution of a great number of interesting problems which are beyond the scope of this article. It has also been found necessary to omit mention of many interesting features of the system and the apparatus. The aim has been to present a bird's-eye view of the system as a whole and its fundamental underlying principles. The advent of the system doubtless marks an epoch in the history of the telegraph. The success achieved is the result of the concentration on a single problem of a number of minds, each particularly well equipped with knowledge and experience for the consideration of some important phase of the problem. Nor has the work of earlier investigators been neglected. The multiplex principle of Baudot and the five-unit code used by him over thirty years ago form the foundation of the system.

It remained, none the less, for Mr. Donald Murray, who had previously developed a high-speed system using the Baudot five-unit code, to appreciate the inherent advantages of the Baudot multiplex principle. This he incorporated in the Murray multiplex system, which included machine sending and column printing. Although novel in many respects, the system described is not altogether an innovation, but is rather the realization and working out of old principles which have been tried and found successful.

DIGEST OF ELECTRICAL LITERATURE

Generators, Motors and Transformers

Total Losses in Iron.—N. W. McLachlan.—An account of a series of experiments the object of which was to ascertain whether the total number of watts lost per kilogram could be expressed in the form $W = cB^n$, as an alternative to the usual expression $W = aB^{1.6} + bB^2$, in which the hysteresis and eddy-current losses are considered separately. The chief results are as follows: For flux densities between 4000 and 10,000 lines per square centimeter, and frequencies between twenty-five and sixty cycles per second, the combined hysteresis and eddy-current losses in the special alloy steel "stalloy" (0.5-mm plates) or in ordinary iron (1-mm plates) subjected to an alternating magnetization can be represented within 1.5 per cent by an expression having the form $W = cB^n$, n varying from 1.68 to 1.77 for "stalloy"

VARIATION OF COEFFICIENTS WITH FREQUENCY

	Stalloy		Lohys		Ordinary Iron	
f	n	$c\times10^3$	n	$c\times10^3$	n	$c\times10^3$
25	1.68	2.16	1.73	1.76	1.75	2.92
37	1.72	2.29	1.77	2.04	1.78	3.78
50	1.75	2.66	1.80	2.32	1.81	4.64
60	1.77	2.83	1.82	2.49	1.83	4.98

and from 1.75 to 1.83 for ordinary iron. For flux densities between 5000 and 10,000 and frequencies between twenty-five and sixty the combined hysteresis and eddy-current losses in "lohys" (0.37-mm plates) subjected to an alternating magnetization can be represented within 2.5 per cent by an expression having the form $W = cB^n$, n varying from 1.73 to 1.82. In the expression $W = cB^n$, c varies directly as the frequency f and log n directly as log f. How the coefficients n and c vary with the frequency f for "stalloy" and "lohys" and ordinary iron is shown in the table. Some mathematical appendixes are added.—*Journal Inst. of Elect. Eng.* (London), March 1, 1915.

Compensator.—T. F. Wall.—An article on the Leblanc-Latour-Scherbius compensator, which is based on the principle that the current leads the emf in a polyphase commutator armature driven above synchronous speed. The author outlines the theory of this compensator and then supports the theory by experimental results.—London *Electrician*, March 12, 1915.

Lamps and Lighting

Searchlamp Projectors.—C. W. Denney.—The first part of an illustrated article dealing with recent improvements in searchlamp projectors (especially the substitution of the gilded metallic mirror for the silvered-glass mirror), with methods of focusing a projector lamp, details of the flashing gear, and construction of the projector lamp. The article is to be concluded.—London *Elec. Review*, March 15, 1915.

Generation, Transmission and Distribution

Transient Phenomena in Coils with Capacity Between Turns.—Karl Willy Wagner.—In an insulation test of a coil of a large 15,000-volt generator the following accident happened. The insulation of the coil against iron was to be tested at 30,000 volts, the connections being as shown in Fig. 1. The horn lightning arrester H in parallel with the testing transformer T was so adjusted as to operate at 33,000 volts in case an excessive voltage should occur. When the lightning arrester operated accidentally there was a big flash at the coil, and it was found that the insulation between different windings of the coil had been perforated at many places, while the insulation of the coil against the iron I had not been damaged. The accident was found to be due to the discharge wave which entered the coil from the

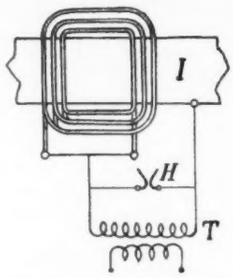


FIG. 1—CONNECTIONS FOR INSULATION TEST

horn lightning arrester. The remedy consisted in connecting a high resistance in series with the lightning arrester. This resistance prevents any appreciable decrease of the voltage at the terminals of the coil in case the lightning arrester operates. In this case no discharge wave will enter the coil. Experiments confirmed this explanation. The theory of excessively high voltages in electric circuits with uniformly distributed inductance and capacity can be based on the phenomenon that electromagnetic waves travel along the conductor with the velocity of light without being distorted. The author calls attention to the fact that this theory cannot be applied directly to the case of the wave entering the windings of the transformer or generator because the winding capacity of the coil must be taken into consideration. The author gives a sketch of the mathema-

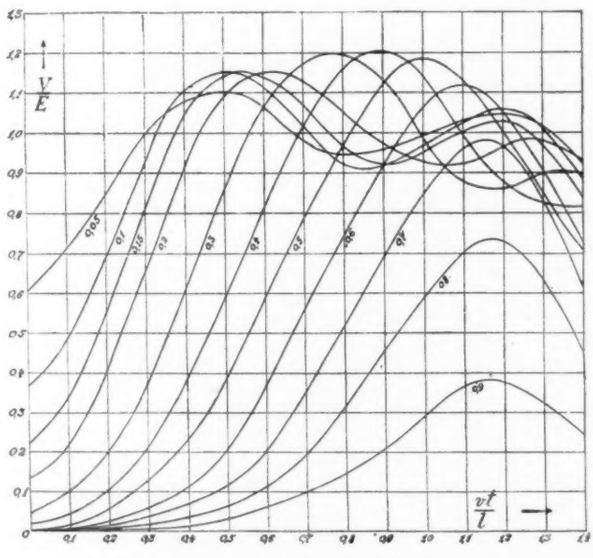


FIG. 2—VARIATIONS OF VOLTAGE WITH TIME

tical theory of the transient phenomena in a wound coil when a constant emf is suddenly impressed across its terminals, and shows how to calculate the natural frequencies of the oscillations produced. He shows that a wave which enters a coil is distorted since it has no longer a steep front so that the excess voltage is smaller. On the other hand, the time is longer during which the

excess voltage exists. The turns near the start of the winding are more affected than the turns in the center of the winding. The wave is reflected at the center of the coil. In the turns between the beginning of the windings and the center the voltage against earth becomes for a time greater than the emf at the beginning of the winding. Fig. 2 shows the variations of the voltage V with time at different points in a coil on which the constant emf E is suddenly impressed. The abscissas represent time and the curves 0.05, 0.1, 0.15 . . . relate to points further and further away from the starting points of the coil. The figures 0.05, 0.1, 0.15 represent the ratio x to l where l is the length of the winding and x the distance from the starting point.—*Elek. u. Masch.* (Vienna), Feb. 21 and 28, 1915.

Installations, Systems and Appliances

Charging for Energy.—BUEGGELN.—Stuttgart was the first German city which introduced a double-rate schedule for energy, namely, 15 cents and 10 cents per kw-hr. for lighting and 10 cents and 4.5 cents for motor service. The lighting rates were later reduced to 12.5 cents and 7.5 cents per kw-hr. There was a rather high charge for meter rent or meter sale, and the experiences with the schedule were not pleasant. It was therefore discontinued three years ago, and for small consumers the price of the kilowatt-hour for lighting was made 7.5 cents for the months of March to September and 10 cents for the other months, while the uniform charge of 5 cents per kw-hr. was made for motor service. For large consumers a special rate was made which consists of three parts, namely, first, a fundamental charge of $27 per kilowatt; second, a charge for administration ($9 per connection), and, third, a charge for the energy consumed ranging from 2.1 cents to 1.25 cents per kw-hr. according to the total energy used. Recently a third rate has been introduced for private residences only, and consumers have a right to select either this new schedule or the rate according to the meter. The new schedule is based on a flat rate according to the size of the residence (number of rooms, not including kitchen, servant's room, laundry, etc.). For this flat rate a certain number of kilowatt-hours is furnished per year according to the following schedule: For two rooms a monthly charge of 50 cents is made for 100 kw-hr. furnished per year; for three rooms, 63 cents, for 125 kw-hr. per year; for four rooms, 82 cents, for 165 kw-hr.; for five rooms, $1, for 200 kw-hr.; for six rooms, $1.25, for 250 kw-hr.; for seven rooms, $1.50, for 300 kw-hr., and for each additional room, 25 cents, for 50 kw-hr per year. According to this schedule 1 kw-hr. costs 6 cents, including meter rent, and for each additional kilowatt-hour a charge of 3.75 cents is made. Although the consumers have the choice between this flat rate and a pure meter rate, many have preferred the flat rate from the start.—*Elek. Zeit.*, Feb. 25, 1915.

Electric Cooking.—W. R. COOPER.—A paper read before the (British) Institution of Electrical Engineers on electric cooking, mainly from the consumer's point of view. The author gives full details of the energy-consumption cost per year, compared with coal outlay and losses in cooking, in a definite electric-cooking installation for a household of eight to nine. Various suggestions with regard to earthing of cooking plant are made, and the question of rates and maintenance charges is discussed. Load curves for an average week are given. The author thinks "it would be an excellent thing if all station engineers were compelled to employ electric cooking exclusively in their homes, and also to pay for the energy so consumed. This would not only familiarize them with the apparatus, but would show them the defects of some of the tariffs that they try to inflict on other people." Load curves are given which show that the cooking load is of a desirable kind, for it is well distributed throughout the day. Apart from this, two things are noticeable. The first is that the consumption in any part of the day varies considerably. For example, if the meter readings are noted three times a day at regular hours, it is found that the amount consumed in any one of those intervals varies considerably from day to day. The second point is that the character of the load varies from day to day. Consequently the combined loads of, say, half-a-dozen consumers will give a much better curve than that of any one individual.—London *Electrician*, March 12, 1915.

Wires, Wiring and Conduits

Perforation Strength of Oils as Affected by Pressure.—F. KOCK.—The first part of an illustrated account of an experimental investigation of the electric perforation strength of liquid, semi-liquid and solid insulating materials as affected by pressure. The liquid and semi-liquid insulating materials tested were transformer oils, oils used in cable manufacture, vaseline, toluol and benzol. The only solid substance tested was hard rubber. The chief results are as follows: The perforation strength of liquid and semi-liquid insulating materials in the range from 1 atmosphere to 20 atmospheres increases proportionally to the pressure according to the formula, insulation strength $= a + bp$ kv per centimeter, where p is the excess pressure in atmospheres and a and b are constants. For materials free from water a is of the order of magnitude of from 80 kv to 100 kv. When the pressure is increased still further, the perforation strength increases less rapidly and finally approaches a limit which is different for different materials. The perforation strength of solid hard rubber is independent of the pressure up to 50 atmospheres. For liquid and semi-liquid insulating materials the perforation strength is almost independent of the thickness of the layer, although there is a very slight increase with thickness. The paper is to be concluded.—*Elek. Zeit.*, Feb. 25, 1915.

Heating Plug.—An illustrated detailed description of the construction of a heating plug which has been adopted by A. N. Moore, of Newport, Monmouthshire, as standard for that town. It is a heating plug of the hand-shield type for use in private houses.—London *Electrician*, March 12, 1915.

Electrophysics and Magnetism

Effect of Temperature on Magnetic Permeability.—RAYMOND L. SANFORD.—In magnetic measurements at the Bureau of Standards it has been found that for magnetizing forces between 100 and 300 gausses the heating due to the current in the magnetizing coils is sufficient to change quite appreciably the induction corresponding to a given magnetizing force. For this reason it has been the practice, when making measurements where an accuracy of 1 per cent is desired, to immerse the magnetizing coils in oil, which is maintained at a standard temperature of 25 deg. C. The present work was undertaken to determine what the magnitude of this temperature effect is and whether it is feasible to apply a correction for the reduction to a standard temperature of data taken at other temperatures. The results of the experiments are given in a series of tables and diagrams, and the following general conclusions are drawn: The temperature coefficient of magnetic permeability, though small, cannot be neglected in magnetic measurements of high accuracy. On account of the wide variation in temperature coefficient, not only for different materials but also for the same material with different heat treatments, correction cannot be made to standard temperature from data obtained from other materials. Unless the temperature coeffi-

cient is known for the particular material under test, temperature control offers the only means of avoiding the error due to temperature changes, at least where errors as great as 1 per cent are to be avoided. Conditions often arise in practice where the temperature of a specimen may be raised by from 10 deg. to 20 deg. above the temperature of the room, owing either to a comparatively heavy current or to the use of coils already heated from the previous test. Since temperature coefficients may be as great as 0.3 per cent per degree, errors amounting to 2 per cent or more may exist.—*Scient. Papers, Bureau of Standards*, No. 245. Jan. 30, 1915.

Electrochemistry and Batteries

A Galvanic Cell Which Reverses Its Polarity When Illuminated.—A. A. CAMPBELL SWINTON.—A brief abstract of a British Physical Society paper. When two plates—one of zinc and the other of tinned copper coated on one surface with selenium and varnished with enamel over the remainder of its surface—are immersed in tap water, the electric current through a galvanometer connected to the plates shows that in the dark the zinc is electro-positive to the selenium, while the result of light falling on the selenium is to increase the effect. If, however, instead of zinc, carbon or copper is employed for the non-coated plate, the interesting result is obtained that, while the selenium proves to be electro-positive to the carbon or copper in the dark, it immediately becomes electro-negative to carbon or to copper when it is illuminated, this being easily shown by the deflections of the galvanometer in contrary directions as the light is turned on and off.—London *Electrician*, March 5, 1915.

Units, Measurements and Instruments

Resistance Thermometer.—S. LEROY BROWN.—While metallic oxides are generally considered to be non-conductors at room temperature, they may become conductors at higher temperature. The author gives the results of a determination of the resistance of oxides which have been melted and molded into solid rods, and shows the application of their resistance variation with temperature for resistance thermometers. Solid rods were obtained by filling porcelain tubes with powdered or solid forms of the oxides and melting the oxide by placing the tubes in a tubular electric furnace. Iron oxide (Fe_3O_4) and cuprous oxide (Cu_2O) gave the most satisfactory results (as far as the author's investigation was extended) for temperatures ranging from a few degrees below zero to from 400 deg. to 500 deg. C., although lead oxide (PbO) can be used very satisfactorily between 100 deg. and 600 deg. C. The lead oxide is more brittle than either iron or copper oxide, and therefore is easily cracked or chipped. The extremely high resistance of lead oxide at room temperatures necessitates a very thin element in order that its resistance shall not be prohibitive. The results obtained for the different oxides are given in form of tables and diagrams. The sensibility of a magnetite (Fe_3O_4) thermometer and of a platinum resistance thermometer are shown in Fig. 3. A comparison of the two curves shows that the magnetite thermometer is about sixteen times as sensitive as the platinum thermometer at ice temperature, and about eight times as sensitive as the platinum thermometer at room temperatures.—*Physical Review*, February, 1915.

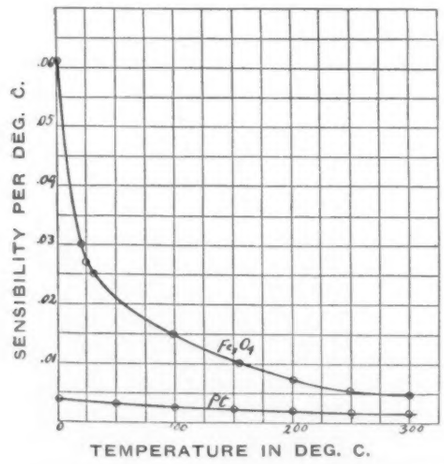


FIG. 3—VARIATION OF SENSIBILITY WITH TEMPERATURE

Miscellaneous

Training for the Industrial Side of Engineering.—A P. M. FLEMING.—The author divided his subject into two broad classes—non-technical employment and technical employment. Under the first head he discusses the requirement of training for trades apprenticeship, the value of pre-apprenticeship to training. Foreign methods of training and trades apprentice schools are dealt with. Under the second head he first classifies the various branches of employment and then goes on to discuss the methods of training for these.—London *Electrician*, March 12, 1915.

Association of Central Stations.—An account of the proceedings of the twenty-third general meeting of the German Association of Central Stations, held in Freiburg from June 17 to 19, 1914, with brief abstracts of the papers presented and of the discussions.—*Elek. Zeit.*, Feb. 11, 1915.

Book Review

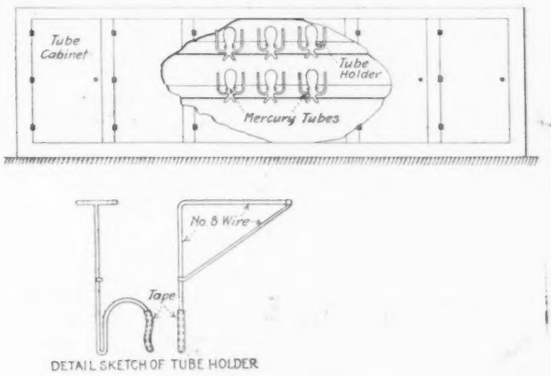
WIRING OF FINISHED BUILDINGS. By Terrell Croft. New York: McGraw-Hill Book Company, Inc. 276 pages, 205 illus. Price, $2.

This book is a practical treatise dealing with the commercial and technical phases of the subject of the wiring of finished buildings, and as such it should prove of great value not only to the electrical contractor and wireman but to the central-station man as well. It is divided into a commercial and a technical section. In the former are considered the possibilities and results of an existing-building wiring campaign, methods of advertising and solicitation employed, policies underlying such campaigns, examples of campaigns, costs and prices for finished-building wiring, and specifications for campaigns. Some of this section is compiled from articles that have appeared in the technical press from time to time, but much new material is added. The result is a thorough discussion of the commercial phases of the subject that should prove of value to all contemplating existing-building wiring campaigns. The second section of the book considers such subjects as methods of wiring, planning installations, tools and manipulation, examples of installations and examples of fixtures employed. This section, like the first, is of very practical nature. The subjects mentioned are discussed in detail, no attempt being made to cover such extraneous matter as the wiring methods common to both new-building and old-building wiring. Halftone illustrations have been entirely dispensed with, and there have been substituted therefor easily understood line drawings. These illustrations, being numerous in both sections of the book and of excellent nature, serve to enhance the value of this practical and long-needed treatise.

POWER AND OPERATING SECTION

Method of Storing and Handling Mercury-Rectifier Tubes

From the lighting and railway power house of the Terre Haute, Indianapolis & Eastern Traction Company at Terre Haute, Ind., many direct-current arc-lamp circuits are served. To facilitate systematic handling of the mercury-arc converter tubes which are used on these circuits, a special cabinet has been built against one wall on the switching gallery near the arc-lamp rectifier apparatus. As the tubes are needed to



RACK FOR MERCURY-VAPOR TUBES

replace worn-out units they are taken from the end of the cabinet at the right. When a new shipment of tubes arrives at the plant they are placed in the cabinet at the left end, those on hand being moved toward the right end to make room for those most recently purchased. Hence the operators are continually using those tubes which have been longest on hand at the station.

To support each tube in the cabinet an ingeniously devised hanger is used. It is fashioned from a single piece of No. 8 steel wire, and the spring tip which grasps the tube about its middle is covered with tape. The hangers fastened to longitudinal strips against the rear wall of the cabinet afford convenient and safe positions for the rectifier tubes.

Electric Arc Welding

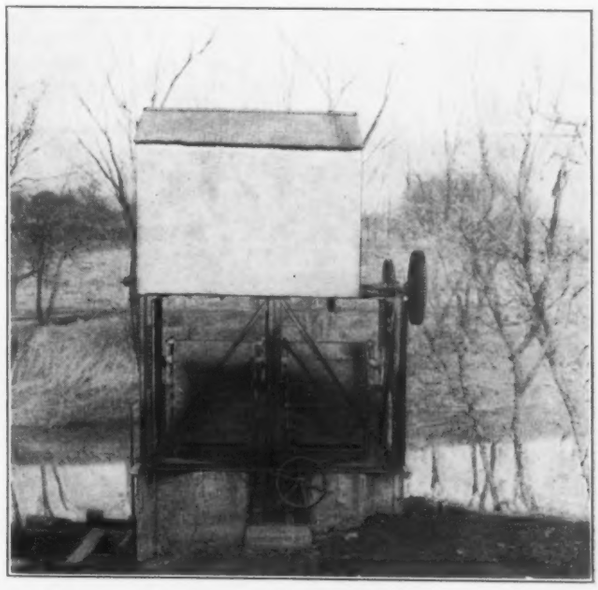
In a paper devoted to some of the fundamental principles of arc welding for the benefit of the manufacturer, Mr. J. F. Lincoln, at the recent meeting of the A. I. E. E. in Cleveland, answered some of the more important questions in connection with this application of electricity. Owing to the ease of application and the economy with which heat can be concentrated at any given point, the electric arc is superior to other methods of heating. The difficulties encountered in welding—namely, formation of oxide, expansion and contraction and burning through—were discussed and remedies offered. In connection with the difficulty of arc welding the author stated that it does not require anything like as skilful handling to make a good arc weld as it does to make a weld on an anvil. The author discussed the questions of strength of weld, adaptability of method, and essential features of different types of arc-welding machines. Some valuable estimates of cost of energy for operation under average conditions were also given.

The discussion brought out considerable difference of opinion concerning the relative merits of electric-arc and oxy-acetylene welding processes, especially for work in cast iron. In railroad shops both methods were said to be in use, a slight preference at present being given to the gas processes. In closing the discussion, Mr. J. F. Lincoln contended that with gas at 2 cents per cu. ft. and with electricity at 2 cents per kw-hr. electric welding could be carried on from 3 per cent to 30 per cent cheaper than oxy-acetylene welding. In answer to a question concerning the welding machine mentioned in his paper the author said that, although it was designed primarily to supply energy to only a single operator, the saving which the machine will effect is so great that the purchase of several machines can economically be made if they are needed. Those who took part in the discussion were Messrs. L. P. Crecelius of Cleveland, A. S. Bemis of Cleveland and D. B. Rushmore of Schenectady. A written discussion by Mr. E. M. Zook of Pittsburgh was read by A. M. Dudley of Pittsburgh.

An Intake Screen Unaffected by Floods

Taking water from a stream in which there is always a considerable rise during the rainy season, the plant of the Springfield (Ohio) Light, Heat & Power Company is in a position requiring that some arrangement be made for cleaning the intake screens at such times of high water. How this problem has been met is shown in the accompanying photograph. At the entrance to the intake tunnel on a concrete base is a rotary screen equipped with a chain and gear drive connecting it with a 5-hp motor inclosed in the corrugated metal housing above.

When the motor is started by closing a switch in the adjacent power house the screen revolves over the drum suspended beneath the motor house, bringing a new por-



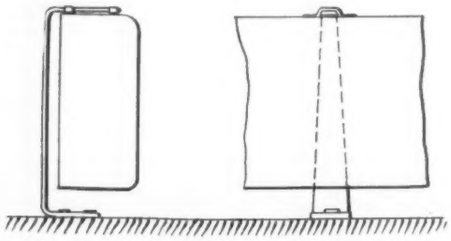
REMOTE-CONTROLLED MOTOR-OPERATED INTAKE SCREEN

tion of the sectionalized screen before the mouth of the intake. As the screen revolves it moves upward on the side nearer the stream and downward on the shore side. With this rotary motion in progress some of the accumulated debris lying at the mouth of the tunnel is carried up by the screen itself and by paddles fastened to the screen for this purpose. Hence, when the screen

is shifted the entrance to the tunnel is automatically cleared of the litter, which, if allowed to accumulate, would ultimately stop the inward flow of water.

Removable Guard for Motor Pulley or Belt

Protective guards for moving pulleys and belts are often of the greatest value as a means of safeguarding

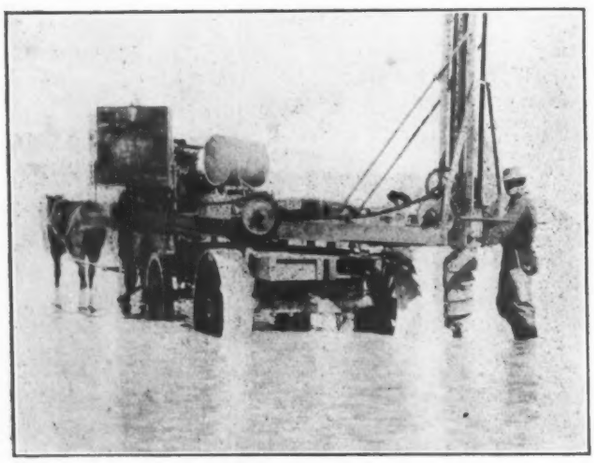


REMOVABLE GUARD FOR BELT

the life and limb of operatives who are required to work in the vicinity of moving machinery. Where such guards are installed permanently, however, so that they cannot be removed without dismantling, the guard may be a source of considerable inconvenience and even give rise to distinct danger through lack of inspection and attention. Belt guards of this kind should therefore be made removable. The accompanying sketch indicates a form of support in which the strap-iron holder slips into a pocket mounted on the sheet-metal casing. The case can be conveniently removed from the supports by simply pulling it off in the direction of the pocket.

Machine Making Fifty Post Holes an Hour

Making fifty post holes an hour is a rather unusual record, but it was done under very unsatisfactory conditions with the machine illustrated herewith when the transcontinental telephone line was being constructed. The equipment consisted of an auger attached to a



BORING POST HOLES IN LAKE BED

weight sliding between vertical guides and rotated by means of an internal-combustion engine carried on the same platform which supported the guides. The lifting of the auger and its speed were controlled by levers near the base of the guides. The platform was supported on a turntable so the auger could be shifted in its position. This equipment bored holes satisfactorily even in the bed of shallow lakes which it was necessary to cross. Probably a better idea of its utility is given by the fact that 400 miles of line were erected in ninety days. The Mountain States Telephone & Telegraph Company had charge of construction work from Denver, Col., to Wendover, Utah, and the Pacific Telephone & Telegraph Company from Wendover to the coast.

Purpose of High-Tension Equipment Indicated on Ceiling Beams

Whenever an accident happens on an electric-service system it is highly important that the station attendants be enabled to find control apparatus quickly. Marks on the various devices themselves are not in every case satisfactory as they cannot always be placed in con-

SECTION OF SWITCH GALLERY

spicuous positions. At the generating station of the United Electric Light & Power Company, New York City, the ceiling beams over the equipment are marked so that an attendant can tell at a distance just where a certain piece of apparatus is installed. Additional labels on the apparatus prevent misinterpretation of the signs on the ceiling.

Detecting Production Losses with a Tachograph

With the aid of a recording tachograph, a device which shows the momentary speed variation occurring in the shaft or machine to which it is connected, the commercial department of the Dayton Power & Light Company, Dayton, Ohio, was recently able to show a prospective customer that his engine-driven factory shafting underwent a recurring speed loss of 6 per cent during each revolution. The same tachograph applied to a similar installation driven by an electric motor showed speed variations reaching a maximum of only 0.5 per

cent. Such a tachograph, according to Mr. J. C. Matthieu, power engineer for the company, is of great usefulness in revealing the production losses due to speed changes in engine-driven factories and in preparing the way for the obvious remedy—electric motor drive.

Cable Puller Operated with Storage-Battery Energy

Shown in the accompanying illustration is a battery-operated cable puller employed by the underground distribution department of the Edison Electric Illuminating Company of Brooklyn. The cable puller is a specially constructed electric truck with the motor supported so it can be employed to propel the vehicle or to operate the drum drawing the cable through the duct. The parallel steel bars standing vertically in the manhole at the end of the truck are to support pulleys for guiding the drawing-in rope. One pulley is installed opposite the duct outlet and another is placed just above the level of the truck platform. To permit placing the pulleys in the correct positions holes for the pins have

CABLE PULLER EQUIPPED WITH STORAGE BATTERY

been drilled about 6 in. apart in each bar. The truck wheels do not have to be blocked when installing cable as the cable puller is prevented from moving by allowing it to press against the vertical steel bars supporting the pulleys.

From actual test with this equipment it has been found that about 3 hp is required to pull cable through a 227-ft. duct at the rate of 1 ft. per second. As many as 2497 ft. of cable have been pulled with the machine in a day. The longest piece of cable which has so far been pulled was 430 ft. in length. The vehicle is equipped with a 5-hp motor.

Causes of Poor Commutation and Remedies

Some of the causes of poor commutation and brush troubles, methods of locating them, and remedies therefor were given in a paper entitled "Some Troubles Encountered in the Operation of Carbon Brushes in Direct-Current Generators and Motors," which was presented by Mr. E. H. Martindale before the annual meeting of the Cleveland Section of the American Institute of Electrical Engineers. The troubles were classified according to the location of the causes.

If a partial short-circuit occurs in one coil of a series or series-parallel field winding, it may not affect the temperature of the coil appreciably, but will usually cause severe sparking at one or two studs. In a wave-wound machine, however, the commutation will be very little affected. This trouble can be located by measuring the voltage drop across each coil with a constant current through the windings, the coil showing the lowest drop across terminals being the short-circuited coil.

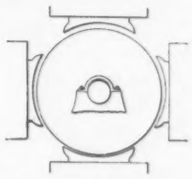


FIG. 1—EFFECT OF WORN BEARINGS

If one series-field coil on a cumulative compound machine is reversed accidentally, sparking will usually occur at two adjacent studs as the load increases. The best way to detect this trouble is to excite the shunt field and series field separately, being sure that the current flows in the same direction as when the machine is in operation. The polarity of each pole should be the same when either field is excited, and furthermore the polarity of adjacent poles should be different. Other indications of a wrongly connected cumulative compound machine are that its voltage will decrease with load if operated as a generator and the speed will increase with load if operated as a motor.

If one pole face is nearer the armature than the others, the flux across its gap will be greater and a higher voltage will be developed in the coils under that pole. Worn bearings are often a cause of unequal air-gaps. If machines with cast frames are employed, blow holes may be present which may increase the reluctance of the magnetic circuit, thereby causing cross armature currents.

An open circuit in an armature coil causes the most vicious form of sparking, which is always accompanied by severe pitting of the mica between the commutator bars connected to the defective coil and the adjacent coils. To locate the break the terminals of an electric-lamp circuit should be touched to adjacent commutator bars until the lamp fails to light. Similar but less pronounced sparking may be caused by a high-resistance connection between the end of a coil and the commutator riser. This can be detected by passing a current through the armature and finding the bars across which the voltage drop is higher than the average. A short-

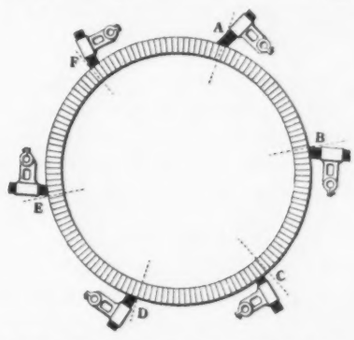


FIG. 2—HOW IMPROPER BRUSH SUPPORT AFFECTS SPACING

circuit between two sections of a coil, two coils in the same slot, end connections of two coils, or between commutator bars will be indicated by excessive heating of the coils affected.

Demagnetizing and cross-magnetizing caused by shifting brushes from the true neutral have serious effects on commutation. If the brushes are shifted far

to obtain good commutation and the magnetization of the pole piece is not well above the knee of the saturation curve, the demagnetizing effect may seriously reduce the voltage of the generator or increase the speed of a motor. Cross-magnetization may be sufficient to place the coils undergoing commutation in a heavy field, thereby causing large short-circuit currents and severe sparking at the brushes. The remedy is to widen the neutral field by filing away the edges of the pole pieces. On stationary machines it is advisable to maintain a brush pressure of 2 lb. to 4 lb. per sq. in., depending on local conditions and the grade of brush. With crane motors, haulage motors, railway motors, etc., 4 lb. to 8 lb. is recommended. Under no conditions should less than 1.5 lb. per sq. in. be used.

If rocker-type brush holders are employed care should be taken to see that they are all inclined at the same angle, otherwise large short-circuit currents may flow through the armature because of unequal spacing. If brushes are too thin, sufficient time is not allowed for commutation, and if they are too thick, the coils may develop electromotive force before they pass out from beneath the brush. Many cases of sparking have been cured by reducing the thickness of the brush. Sparking may also occur if the brush studs or brush holders are not parallel to the commutator bars, or if the

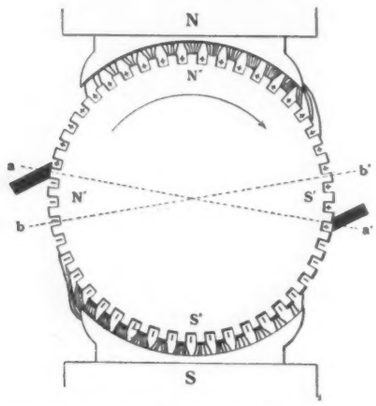


FIG. 3—EFFECT OF BRUSH SHIFT ON ARMATURE FLUX

brushes are not free to follow the surface of the commutator. On machines which have been in service for a long time trouble frequently arises from worn holders, particularly if the machine runs in both directions, as the brush face changes when the machine is reversed. This reduces the time of commutation and increases the current density and may cause the brushes to chatter and chip.

Screeching caused by friction of the brush on the commutator may be relieved by changing the spring tension, angle of operation, grade of brush, or by lubricating the commutator surface at intervals. Chattering caused by high mica or wide slots is indicated by a pitch which corresponds to the number of bars passing under the brush per second. High mica may be removed by undercutting it or employing more abrasive brushes. If the noise is caused by slots, it may be necessary to change the spring tension, angle of operation or grade of brush, as lubrication is not recommended with slotted commutators. Pitting or honeycombing of brush faces is nearly always caused by short-circuit currents, by a very low brush pressure, by the brushes having insufficient cross-section, and occasionally by the brushes having insufficient current-carrying capacity. Positive brushes or generators or negative brushes of motors frequently pick up copper. This may be caused by electrolytic action or by abrasive material in the brush. Copper in the brush face lowers the contact resistance and generally causes large short-circuit currents.

Loose commutator bars which are often unobserved when the machine is not operating may attract attention when the armature is revolving by causing a thumping sound every time they strike a brush. Indication of loose bars or high mica is also given by burned spots on bars each side of the defective spot. Commutator bolts should be tightened a few months after a machine is placed in operation. In replacing commutator bars care should be taken to use material of similar quality, otherwise the new bar will not wear at the same rate as the other. Blackening will sometimes occur on every other bar or every third bar, corresponding to the number of coils per slot, and may be shifted to another set of bars by changing the position of the brushes. This seems to be due to an inductive "kick" in the coil undergoing commutation when the armature tooth next to the coil passes from under the field. The remedy is to have the neutral field wide enough to permit the tooth to leave the strong field before the commutator bar comes under the brush.

When flat spots start to form others spaced equidistant about the commutator usually develop, one for every pair of poles. Flat spots may be caused by the commutator not running true, by soft bars, difference in hardness of mica, surges of current, or any sparking which occurs once every revolution. When commutators are slotted the mica should be undercut about 3/64 in. If the peripheral speed is not sufficient to throw out particles of dust or dirt which accumulate in the slots, they should be blown out or scraped at regular intervals. Non-abrasive brushes should be employed on slotted commutators.

Overloads, line surges and cross-currents between machines operated in parallel may cause commutation troubles and may be difficult to detect unless an oscillograph is employed. Unbalanced armatures, unstable foundations, poor belt lacing or uneven gears, and pounding of direct-connected reciprocating engines may cause serious vibration which will loosen commutator bars or produce sparking.

Mr. Martindale's paper was discussed by Messrs. D. B. Rushmore and R. H. McLain of Schenectady, H. R. Edgecomb of Pittsburgh, D. M. Petty of South Bethlehem, Pa., J. P. Mallett of Elizabeth, N. J., W. C. Kalb, J. H. Lapp, A. M. MacCutcheon and L. P. Crecelius of Cleveland. The only case of inherent brush trouble mentioned in the discussion was one which was occasioned by brushes impregnated with an inferior grade of lubricant. Upon becoming heated in operation these units gave out enough of their lubricant to make the thin carbon-brush surfaces gummy. If when a machine was stopped a brush in cooling shrank away from the commutator, the gum held it up so that when the machine was again started poor commutation resulted. Many cases of poor commutation, however, although commonly ascribed to the brushes, will be found to be not inherent brush troubles but mechanical disarrangements in the brush rigging or in the machine itself. However, a careful study of a poorly commutating machine and its cycle of operations was conceded to be the first logical step to be taken in locating so-called "brush troubles."

Regarding the advisability of brush standardization as recommended by Mr. Martindale, the delegates seemed in general to be agreed. According to Mr. Martindale, letters on the proposed standards had brought out the fact that many brush manufacturers would welcome standardization because it would mean a considerable reduction in the 5000 different types and sizes of brushes which must now be supplied to the trade.

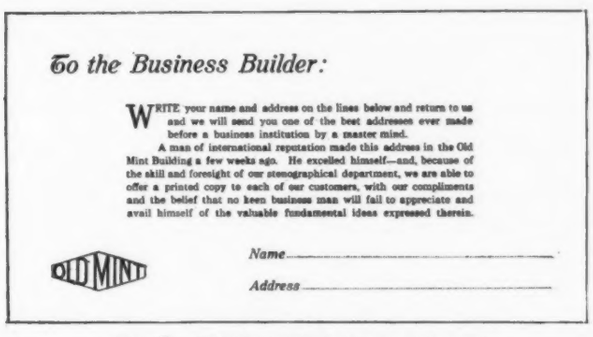
COMMERCIAL SECTION

Indirect Advertising Used by Large Jobbing House

The Frank H. Stewart Electric Company, Philadelphia, Pa., which is said to be the oldest and one of the largest electrical jobbing houses in Philadelphia, makes extensive use of indirect advertising. One example of special interest is that of the publication of a recent

FIG. 1—LOCAL-INTEREST CALENDAR ILLUSTRATION

address by Arthur F. Sheldon, of the Area Institute of Business Technology, in the company's building. The address was printed and neatly bound, and forms such as shown in Fig. 2 were sent to the electrical contractors and dealers in the city and outlying places. In this way some idea of the value of such advertising was obtained, the number of requests for copies of the address being large. Mr. Sheldon's address was one on service and contains an analysis of the term "service" which should be of interest to all engaged in the electrical business. Service, Mr. Sheldon says, is composed of quantity plus quality plus mode of conduct. The latter factor is perhaps the one most commonly overlooked in the electrical business.



To the Business Builder:

WRITE your name and address on the lines below and return to us and we will send you one of the best addresses ever made before a business institution by a master mind.

A man of international reputation made this address in the Old Mint Building a few weeks ago. He excelled himself—and, because of the skill and foresight of our stenographical department, we are able to offer a printed copy to each of our customers, with our compliments and the belief that no keen business man will fail to appreciate and avail himself of the valuable fundamental ideas expressed therein.

OLD MINT

*Name*_____

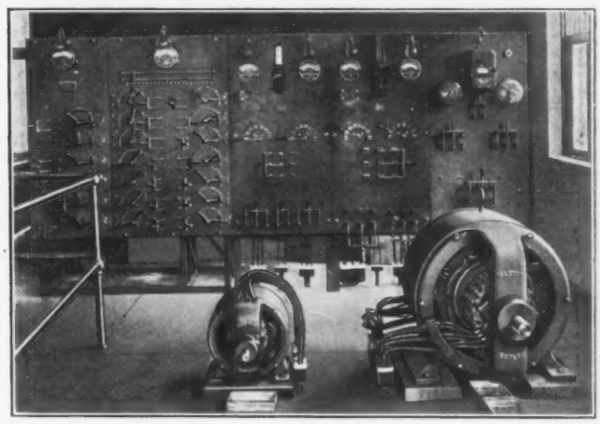
*Address*_____

FIG. 2—FORMS SENT TO CUSTOMERS

All of Mr. Stewart's advertising is of the indirect type. Some idea of the value which he places upon such advertising can be obtained from the fact that the firm spent $3,000 in the production of one calendar. The illustration employed is shown in Fig. 1. It is a reproduction of an original painting of the old mint which occupied the site of the company's place of business. This painting, the property of the firm, has been used in numerous forms, being reproduced for framing and for use on postal cards. In a city such as Philadelphia historical matter is, of course, of unusual interest. This latter type of advertising is one which most firms cannot adopt because of the lack of a historical connection, but it shows the importance of searching for means of interesting the trade in one's business, directly or indirectly, by seeking for and taking advantage of novel or new methods of advertising.

Constant-Potential Charging System Effects Saving in Chicago Garage

Records of electrical energy consumption in the White Garage, at 918 Sheridan Road, Chicago, show that since constant-potential charging apparatus has been installed the energy cost per car per month has dropped from $14.73 to $9.49. The original installation at this garage consisted of seven 30-amp mercury-arc rectifiers and a 12.5-kw motor-generator set with a five-circuit charging panel. This combination of charging apparatus served from fifteen to eighteen cars, and together with a 10-hp elevator motor, a small motor-generator and a tire pump, consumed 9268 kw-hr. per month. A detailed statement of the energy consumption with the old equipment is given in Table I.



ROTARY CONVERTER AND SWITCHBOARD IN THE WHITE GARAGE

When this apparatus proved inadequate it was removed and replaced by two rotary converters made by the Northwestern Electric Company of Chicago. With

TABLE I—DETAILED STATEMENT OF ENERGY USED WITH FORMER EQUIPMENT

Small motor-generator set for charging ignition batteries and tire pump, kw-hr	224
Seven 30-amp rectifiers, kw-hr	4820
Elevator motor (10-hp), kw-hr	81
Motor-generator for battery charging (12.5 kw), kw-hr	4143
Total kw-hr	9268

these new machines, rated at 35 kw and 10 kw respectively, and a charging panel with twenty-five stations, an average of twenty-eight and one-half cars a night have been charged during a month just past. The energy consumption during the same month, including that used by the auxiliaries listed in Table I, was 9800 kw-hr. Table II gives the comparative costs of operating the two installations on the limited-hour alternating-current schedule under which the garage is taking service from the Commonwealth Edison Company.

Inquiries regarding the satisfaction to customers re-

sulting from the adoption of the constant-potential system of charging brought out the fact that the garage

TABLE II—ENERGY COST UNDER OLD AND NEW SYSTEM

	Old Installation	New Installation
First 1000 kw-hr. at 5 cents	$50.00	$50.00
Next 4000 kw-hr. at 3 cents	120.00	120.00
Remainder at 1.1 cents (4268 and 4800 kw-hr.)	46.95	52.80
Total energy charge	$216.95	$222.80
Ten per cent discount deducted	21.69	22.28
Net energy charge	$195.26	$200.52
Demand charge for 50 kw	70.00	70.00
Total electricity bill	$265.26	$270.52
Number of cars charged	18	[illegible]
Cost per car per month for electricity	$14.73	$9.49
Net saving per car	.....	$5.24

has received but one complaint and that this came over the telephone from a man who had driven his car 70 miles on a single charge and was unable to return to the garage.

Water-Pipe Thawing

The Edison Sault Electric Company, of Sault Ste. Marie, Mich., has thawed water pipes by electricity every winter for the past fifteen years. The practice was established by a former manager, Mr. W. F. Kingan, and the method used to-day is substantially the simple one in use fifteen years ago.

An ordinary 20-kw or 30-kw line transformer, 2200/1100-122/244 volts, sixty cycles, on a sleigh, has one of the 224-volt taps connected with heavy wire to a city water hydrant or cut-off, while the other is carried inside the house and securely fastened to a faucet pipe. The 1100-volt primary taps are connected to the outside wires of an ordinary three-wire secondary 220-volt distribution system without switches, fuses or other current-limiting devices. There is usually sufficient resistance in the pipe to keep the flow of current within the limits of the transformer. An ordinary pipe is usually thawed in from three to thirty minutes, the charge being $5.

Handling Out-of-Town Wiring Jobs

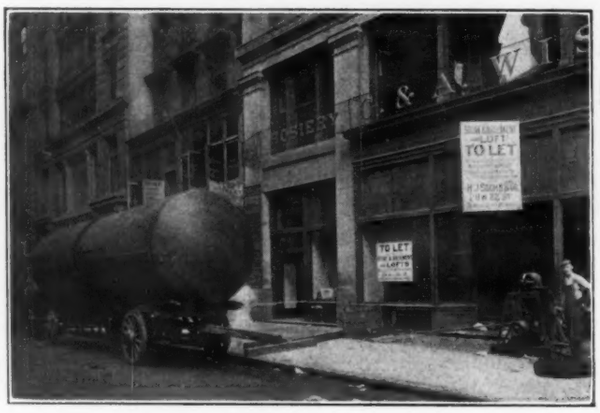
Some of the points to be remembered if out-of-town wiring jobs are to be made profitable for the absentee electrical contractor were outlined by Mr. A. W. Lindgren, of Duluth, Minn., at the recent convention of the Minnesota Electrical Contractors' Association held at Minneapolis.

After the contract is secured the details of the job should be put in charge of the foreman who will supervise the work. The man picked must be willing to go out of town and should preferably be one who will pay his own living expenses while absent. With this foreman the contractor first goes over the plans carefully, preparing a list of the material needed. This list will later be supplemented by periodic requisitions from the foreman on the job. Tools, supplies, materials, etc., must be arranged for in advance wherever possible, and the demands of the work so anticipated that the job will not be delayed waiting for supplies. The foreman should take particular care to follow the specifications closely and to make no deviations or changes unless properly authorized.

Just before the first of each month the foreman should obtain from the architect, or from the latter's inspector, an estimate of the value of the work done to date. Incorporating this in his progress report to headquarters, the foreman furnishes the contractor with information from which the owner can be billed for the proper instalment payment proportionate to the value of the construction then completed. Where payment is arranged for on such a basis—often 85 per cent of the value of material and labor to date—the contractor is enabled to finance the job largely from the customer's payments, without the burden of a large outlay.

Motor Rated at 3 Hp Hoists 9.5-Ton Tank to Roof

The task of hoisting heavy materials during building construction or of lifting some equipment to the upper floors of a completed building would be simplified if simple apparatus like that illustrated herewith were employed. In the case referred to a 9.5-ton cylindrical steel tank had to be hoisted to the roof of the building. A jib carrying a sheave was therefore erected on the roof and allowed to extend over the sidewalk so that a cable could be attached to the tank, run through the sheave, returned through a pulley on the street level, and wound around a motor-driven drum. The pulley at the street level was anchored securely by opening a trap door in the sidewalk and fastening the block to rigid framework. The motor-driven hoist, which consisted of a 3-hp motor mounted on top of a double-A frame and geared to the drum, was also anchored by weighting it and tying to nearby structural pieces. The motor was operated by connecting it with the New York Edison Company's service in an adjoining building. The hoisting equipment was quickly installed and occupied little space so the traffic in the street was not obstructed by any engine.



HOISTING TANK WITH SMALL MOTOR

Electrical Ice-Making in the Twin Cities

Although the twin cities of St. Paul and Minneapolis are surrounded by countless small lakes on which the winter ice crop never fails, while there are at least fifteen lakes within the corporate limits of Minneapolis itself, local ice dealers are finding that artificial ice can be manufactured by electric power to better advantage than the natural product can be cut from the nearby lakes and stored for summer use. The Minneapolis General Electric Company now has a total ice-making load of 510 hp in motors, having recently nearly doubled the rating of its installations. The Consumers' Power Company in St. Paul recently closed a contract for 400 hp in ice-making load, acquiring this business for the central station in competition with the offers of manufacturers of oil engines and other efficient prime-mover units.

Despite the plentiful supply of splendid natural ice,

local dealers declare that, with electrical energy at 1 cent per kw-hr., ice can be manufactured in motor-driven plants situated near the consumer (thus minimizing the cost of delivery) more economically than natural ice can be cut from the lakes and stored six months for consumption during the warm season.

Advance Preparations for the May-First Exodus

Hardly had the first robin signaled the approach of spring before the Commonwealth Edison Company, through timely newspaper advertisements, began to remind Chicago apartment dwellers who intend to move May 1 that they should look well to the electrical equipment of their prospective new homes. First of all, the intending tenant should be careful to select an electric-lighted apartment or dwelling, and, secondly, he should

Are You Going to Move This Spring?
Be sure
that the building to which you will move is equipped for Electric Light.
Electrically-lighted flats or residences are usually more desirable in every way. Landlords, appreciating its advantages from a dollars and cents standpoint, are installing Electric Light even in old buildings every day; the cost is very little.
Electric Light is more than brilliant, healthful and convenient; it is the most economical illuminant. The rates have been constantly reduced until today they are the lowest that they have ever been—easily within the reach of the humblest income

EXAMPLE OF TIMELY ADVERTISING

preferably choose one equipped with baseboard outlets from which cords can be connected to lamps and devices. Several paragraphs of the advertisements which recently appeared in the Chicago papers were directed at the landlords as well as the tenants, and emphasized the low cost of installing electric wiring and baseboard outlets even in old buildings.

Method of Displaying Fixtures

If the entire ceiling of a fixture-display room is hung with sample fixtures, the effect may be more confusing to prospective customers than if the units are supported around the borders of the ceiling and space is left in the center for showing fixtures singly. When it is not desirable to suspend all of the fixtures from the ceiling, racks designed similarly to the one shown herewith may be employed. It consists of a finished board to which are attached ornamental brackets supporting a horizontal rod on which the fixtures can be hung by means of hooks fastened in their upper ends. A number of these racks may be fastened end to end around the walls. With this arrangement any fixture can be taken from its place for closer inspection or can be hung on a hook in the middle of the room to show how it will appear when installed.

In addition to being provided with a hook, each fixture

RACK FOR SUSPENDING FIXTURES

can be equipped with some sort of electrical connecting device which will permit the lamps being lighted when so desired. Bracket fixtures may be fastened to panels set in the walls and connected for electric service. The space below the wall fixture may be devoted to tables, shelves or counters supporting cooking utensils. Beneath these may be drawers. Racks like the one described herewith are employed in the appliance salesroom of one of the United Gas & Electric Engineering Corporation's properties.

Exhaust Fan in Domestic Kitchen

One of the most useful applications of an electric motor about the household, according to an electrical man who has made a special point of having his own home equipped electrically "to the last gasp," is the motor-driven exhaust fan installed in his kitchen. By setting up a draft from the dining room and living quarters into the kitchen, and discharging thence through a window into the open air, cooking odors are effectually kept out of the rest of the house. The fan and motor are mounted in the upper pane of one of the kitchen windows, and the installation is kept in operation while food is being cooked, both winter and summer.

Emphasizing the Service Idea at Cleveland

For the last twelve months Mr. Mathias E. Turner, contract agent of the Cleveland Electric Illuminating Company, has been impressing the Cleveland public with

FIG. 1—ANOTHER EFFECTIVE SIGN

the distinction between mere energy supply and modern central-station service. In the language of the many signs and window displays utilized by the company: "Not merely electric light but also illuminating service. There is a difference." In displaying this legend on

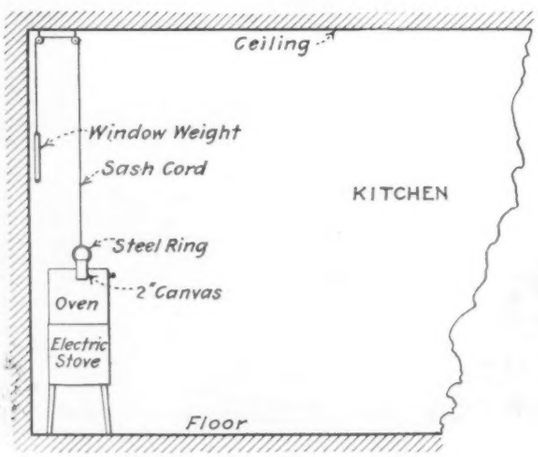
many illuminated signboards in the business section of the city, advantage is taken of a plan used elsewhere and already referred to in these columns by which the electric-lighting company's display is, for a nominal rental, placed on the unrented signboards of a large

FIG. 2—ILLUMINATED SIGNBOARD ADVERTISING AT CLEVELAND

billboard advertising company. The lighting company illuminates the space bearing its advertisement and thus helps to attract other advertisers who may also become purchasers of signboard illumination.

Removing an Objection to the Electric Stove

When some of the customers of the Missouri Public Utilities Company at Poplar Bluff, Mo., suggested that lifting the detachable oven of an electric stove was a heavy task for a frail woman, Mr. F. M. Wilkes, local manager of the electric-service company, overcame the objection by having several ranges installed with counterweighted attachments. The auxiliary apparatus consisted merely of a 2-in. canvas band, a steel ring, a short piece of sash cord, a pair of pulleys and a window weight. The steel ring was slipped over the canvas band and the band attached to the hinges of the oven. From



OVEN LIFTER FOR ELECTRIC RANGE

the ring the sash cord was run over the two pulleys, which were fastened to the ceiling, and the window weight was attached to the opposite end of the cord. Lifting an oven equipped in this fashion is an operation as simple and as easy as raising a window. The plan, shown schematically in the drawing herewith, has the further advantage of placing the oven when not in use in a convenient position where it does not take up any floor space.

Motor-Driven Household Ash Sifter

A Massachusetts man has arranged a fractional-horsepower motor to drive his household ash sifter through a gear and pinion. The motor can be removed and used for other purposes about the house when not needed to operate the ash sifter, but in two years' service the outfit is declared to have saved the entire cost of motor, sifter and mechanism by the fuel reclaimed. An ordinary hand-operated sifter was employed.

Levee Lighting at Lafayette, Ind.

In the flood of March, 1913, the levee which connected Lafayette, Ind., with its neighbor city, West Lafayette, was swept clear of nearly everything which it supported, and in the general destruction the former magnetite street lighting was put out of service. Since that time rehabilitation of the connecting thoroughfare has been

LIGHTING ON LEVEE BETWEEN TWO CITIES

under way, the work consisting of widening both the street and the sidewalks and building a new concrete bridge. The illustration herewith shows a part of the thirty 350-watt gas-filled lamps which will be used to illuminate the new 80-ft. boulevard when it is completed.

Columbus Sign Ordinance

An ordinance passed by the City Council at Columbus, Ohio, will necessitate the removal of all overhanging signs on the streets by Sept. 15. Signs may be replaced parallel to the buildings, but in no case will they be allowed to extend more than 12 in. from the building line. In Columbus there are many electric signs, some of them very handsome, and for this reason the ordinance will result in considerable loss. If replaced as the ordinance allows, the signs will lose much of their effectiveness, since they can be seen only when looking directly toward the walls to which they are affixed. Many merchants on South High Street protested against the passage of the ordinance, but without effect.

NEW APPARATUS AND APPLIANCES

Electrically Heated Glue Pot

In the accompanying illustration is shown a 1-quart electrically operated glue pot. The pot is of sheet aluminum and consists of a containing vessel, a heating element and an outer shell. A steel wire ring is utilized to bind the rims of the outer and inner vessels rigidly together, and a bail of limited range is provided so that it does not get in the way of the heating cord or the brushes. A brush wiper and rest are riveted inside the pot. By means of the air space between the inner and outer vessels heat is distributed evenly over the side and bottom of the containing vessel, eliminating the necessity of a water jacket. According to the manufacturer, the Fearn Company, 206 North Frederic Street, Baltimore, Md., the pot, besides being used for heating glue, for which it is primarily designed, is also being extensively utilized for heating sealing wax, paraffin and chocolate.

ELECTRIC GLUE POT

Large-Sized Insulator for Wireless Towers

In the accompanying illustration is shown an insulator designed for use with wireless apparatus at the United States government station at Arlington. The insulator is 9 in. in diameter and 10 in. high and is provided with petticoats or corrugations to increase the creepage distance for rainy or stormy weather. It is furnished with a metal cap and base for attaching to the bottom of the towers so as to provide an insulated base for the support and insulation of the towers. The insulator weighs 128 lb. and is designed to sustain a compression load of 500,000 lb. Its ultimate strength is said to be 1,150,000 lb. per sq. in. A number of insulators of the above type were made by the Pittsburgh High Voltage Insulator Company, Derry, Pa.

INSULATOR BASE FOR WIRELESS TOWERS

Insulating Composition Material

An insulating material containing boron, which is called "boro-porcelain," is being made by Fred M. Locke, Victor, N. Y. With this material a low dielectric constant and high dielectric and mechanical strength are obtained and the coefficient of expansion is almost as low, it is declared, as fused silica. According to the manufacturer, the voltage required to arc over the surface of an insulator made of this material is 20 per cent to 30 per cent more than for one of high-grade porcelain, and the dielectric strength is 50 per cent greater than that of porcelain. It is especially adapted for use with high-voltage transmission lines.

INSULATOR OF "BORO-PORCELAIN"

Control Equipment for Electric Lift Bridge

The vertical lift bridge over the Willamette River at Portland, Ore., is electrically operated and was designed by Waddel & Harrington, consulting engineers of Kansas City, Mo. On the lower deck provision is made for a double-track railway in a roadway 32 ft. 8 in. wide in the clear. The upper deck provides for a double-track street railway in a roadway 29 ft. 3 in. in the clear between trusses, besides two roadways on cantilevers for vehicle traffic and two sidewalks for pedestrians.

The entire operation is electrical, direct-current motors being used, which take energy from the street-railway circuit. The lower lifting deck is raised to its full height or lowered in thirty seconds, it is declared, and both decks can be raised to their full height or lowered in sixty seconds. To allow passage of river boats the lower deck only is raised, without interfering with traffic on the upper deck. To permit the passage of high-masted sailing vessels, the lower deck telescopes

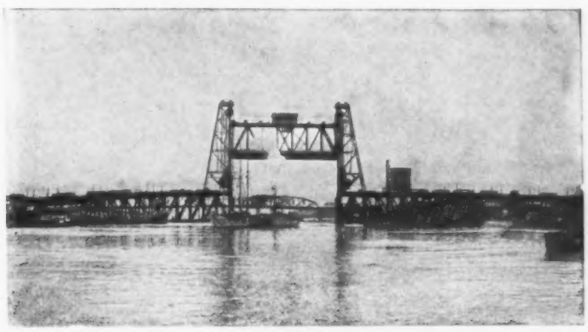


FIG. 1—WILLAMETTE RIVER BRIDGE, PORTLAND, ORE.

with the upper deck, and both are raised to a clear height of 140 ft. above high-water mark, as shown in Fig. 1. The control of the movement of these decks is accomplished by one man, who operates a master remote-control drum. Energy for the motors is distributed through a magnetic switch panel which is connected to the master drum. The control equipment, the control panel of which is shown in Fig. 2, was made by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

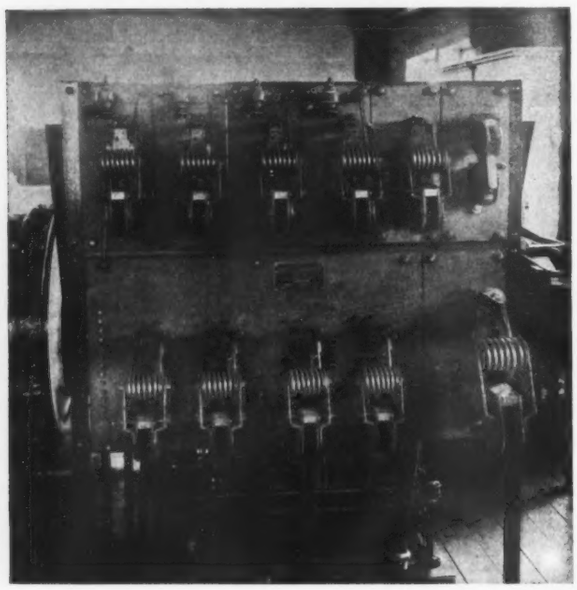


FIG. 2—CONTROL PANEL USED WITH MASTER CONTROLLER

Porcelain Sockets

Various types of key, keyless and pull porcelain sockets, the interior fittings, shells, caps and bases of which are separate as in brass-shell sockets and are interchangeable, have recently been placed on the market by the Weber Electric Company, Schenectady, N. Y., for which Henry D. Sears, 131 State Street, Boston, Mass., is general sales agent. The sockets are wired and assembled in the same manner as brass-shell sockets.

FIGS. 1, 2 AND 3—KEY, KEYLESS AND PULL SOCKETS

The shell is fastened to the cap or base on the outside by two screws. The same kind of chain guides is employed for the porcelain pull sockets as is used in brass-shell sockets made by the above company. The porcelain is finished in either white or chocolate glaze as desired. Old or brush-brass finish is utilized on chains, chain guides and fixture caps.

Tubular Flashlamps Shaped Like Fountain Pen

A flashlamp which is similar in shape to a fountain pen, although somewhat larger, is being placed on the market by the Interstate Electric Novelty Company, 29 Park Place, New York. The device is equipped with a

"FOUNTAIN-PEN" FLASHLAMP

"radio lens" tungsten lamp, as it is called, and a clip, as shown in the accompanying illustration, for fastening the device to the clothing. The device is called the "Franco penlite" and is made in black, nickel or oxidized finish.

Two-Passenger Gasoline-Electric Automobile

In Fig. 1 is shown a gasoline-electric car which is used for testing purposes by the manufacturer, the Galt Motor Company, Galt, Ont. This car is similar to the five-passenger automobile described in the ELECTRICAL WORLD of Feb. 6. The equipment includes a slow-

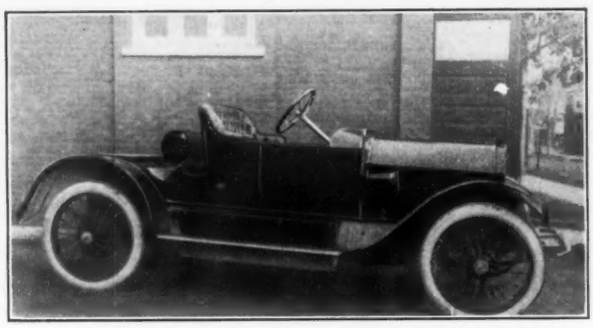


FIG. 1—TWO-PASSENGER GASOLINE-ELECTRIC CAR

speed two-cylinder engine operating at a speed of 700 r.p.m. with a compression of 160 lb. per sq. in., a 50-volt generator operating at a speed of 700 r.p.m., a 44-volt motor operating at 1300 r.p.m. and a 48-volt battery with a rating of 140 amp-hr. The weight of the equipment is 450 lb. The outfit measures 24 in. over all and is rated at 6 kw. Fig. 2 shows the arrangement of instruments on the dashboard. The rheostat is used only for testing. The upper switch is for cranking the engine, using the generator as a motor. The lower switch is connected to the motor circuit. The controller is so designed that the car can be driven at five speeds forward and three reverse speeds. The speed varies from 3 miles per hour to 30 miles per hour.

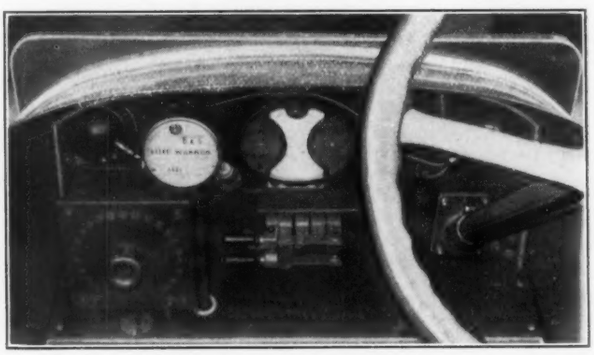
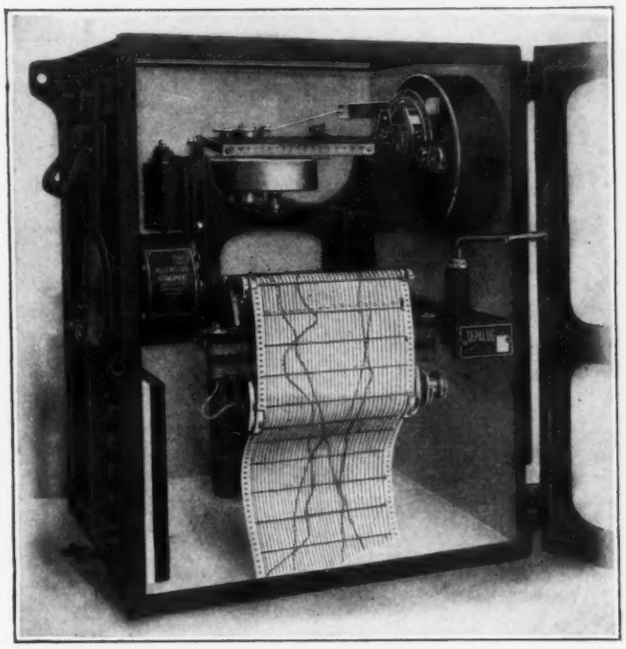


FIG. 2—ARRANGEMENT OF INSTRUMENTS ON DASHBOARD

Temperature Recorder

A recording instrument called the "tapalog," which is designed for use with thermocouples and which is also adapted for recording low voltages or small amounts of current, has just been developed by the Wilson-Maeulen Company, 1 East Forty-second Street, New



INSTRUMENT FOR RECORDING TEMPERATURES WITH THERMOCOUPLES

York. Records are made on a sheet of paper as shown in the accompanying illustration, by dots, one dot being marked every twelve seconds. An indicating scale is mounted along the front edge of a chopping boom which crosses the tip of a pointer approximately at a right angle. The recording paper, which is transparent tracing paper, passes under the pointer. A typewriter ribbon in endless-band form travels around two pulleys and runs under the record paper and at right angles to the direction of travel of the paper. Paralleling the typewriter ribbon and under it is a bar with a sharp edge along the top. The tip of the pointer of the galvanometer is hard, and the chopper boom intermittently strikes the tip of the pointer; where the pointer crosses the straight edge under the ribbon a small dot is recorded on the under side of the paper which is visible from the top surface.

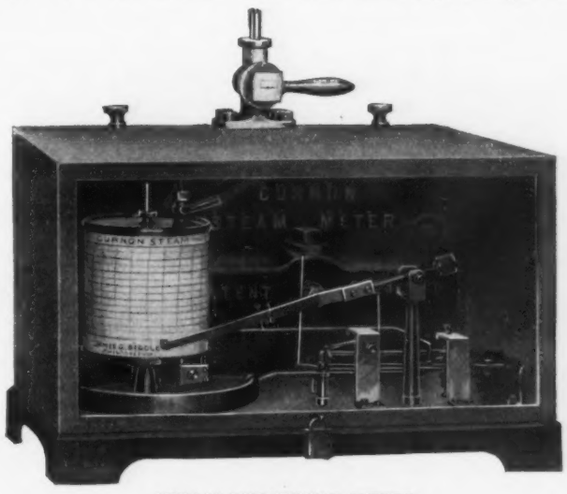
The typewriter ribbon is made to oscillate transversely to its feed by a crank motion which distributes the wear in something like a sine wave. The ribbon is also driven belt-fashion so that there is no chance of wearing a dry space in the typewriter ribbon, even if the record is taken at practically one point of the scale.

The chopper boom is over-counterbalanced and tends to rise of its own accord but is pulled down by an electromagnet. The circuit operating the electromagnet is closed during the whole downward stroke of the chopper, though at the very bottom of the stroke the contact is opened and set back of a detent. The chopper then tends to fly up, but is caused to engage with a wheel on one of the clock spindles and cannot rise faster than the clock spindle turns so that the clock retards the upward motion of the chopper and therefore furnishes the timing and the interval between chops. When the chopper has risen to a suitable position it releases the detent and the circuit is closed and the chopper forced downward again by the electromagnet, repeating the cycle. The contact itself is formed between a piece of platinum-rhodium on the end of a lever and a spiral wire on the periphery of a rotating wheel which is on the clock spindle. When the detent is released the contact lever strikes the contact wheel a blow which closes the circuit. To guard against the possibility of having mechanical contact without electrical contact one of the contacts is continually rotating.

In its simplest form the instrument is designed to take a record of one point in one color; but an attachment can be provided making more than one record, as shown at the left in the illustration, which consists of a rotary switch with gold slide wires mounted on bakelite disks and with scraping platinum contacts. The switch is operated by an electromagnet connected in parallel with that operating the chopper. The instrument is so designed that after either four or eight blows of the chopper the switch shifts and the typewriter ribbon, which in the case of the multiple-record instrument, is a multi-color ribbon, shifts so as to bring a new color under the pointer, and the record of two, three or four points can be taken each in a distinctive color, these colors being for the four-record instrument red, black, green and violet. The carriage containing the record paper, typewriter ribbon, etc., is pivoted so that it will drop forward and downward in order that the paper and ribbon can be changed at a point away from the sensitive galvanometer. The carriage is then lifted into position and is held there by a lock bar to which the battery circuit for operating the instrument is connected. If the lock bar is withdrawn before lowering the carriage, the battery circuit is opened. The instrument is inclosed in a dust-proof metal case with a plate-glass front and top.

Steam Meters

An instrument for recording the amount of steam used in a plant is shown in the accompanying illustration. The charts employed with the meter are calibrated directly in pounds of steam per hour, and corrections are automatically made for fluctuations of boiler pressure. The operation of the instrument is based on the principle of the Pitot tube. Two small tubes with one end of each bent at a right angle are



STEAM-RECORDING METER

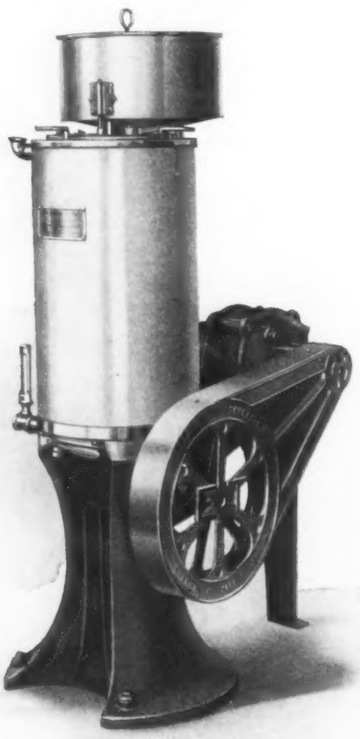
inserted in the pipe in which the steam is flowing in such a position that the end of one faces the direction of the flow and the other is turned in the opposite direction. The rush of steam past the tubes causes in one a slight increase and in the other a corresponding decrease in the static pressure in the pipe. The difference in pressure is a measure of the velocity of the steam,

and by connecting the two tubes to a sensitive differential pressure recorder a record is obtained of the quantity of steam passing through the pipe. A single three-way cock controls both tubes and also enables steam to be blown through the tube periodically for cleaning purposes.

All moving parts of the instrument are mounted on a solid cast-iron base and back-plate and are covered by an aluminum case with glass front, as shown in the accompanying illustration. The outside dimensions are 15 in. by 9 in. by 9 in., and the weight is 50 lb. The two pressures in the test plug act upon the two sides of a sensitive diaphragm, the movements of which are transmitted to a pen through a system of levers in such a way that the curve traced upon the paper chart represents the weight of steam passing. An automatic pressure regulator consisting of a hollow spring of the Bourdon type is provided for taking care of the variations in boiler pressure. Connection between the meter and the test plug is made by $\frac{3}{8}$-in. copper tubing. Interposed between the plug and the meter are condenser coils, which consist of $\frac{3}{8}$-in. copper tubing, the function of which is to provide the meter as well as the connecting pipes with comparatively cool water. The device is called the "Curnon" steam meter, and it is being placed on the market by James G. Biddle, 1211 Arch Street, Philadelphia, Pa.

Motor-Driven Ice-Cream Freezer

The ice-cream freezer shown herewith is driven by a 1-hp or 2-hp motor according to the service required and is operated in connection with a refrigerating plant.

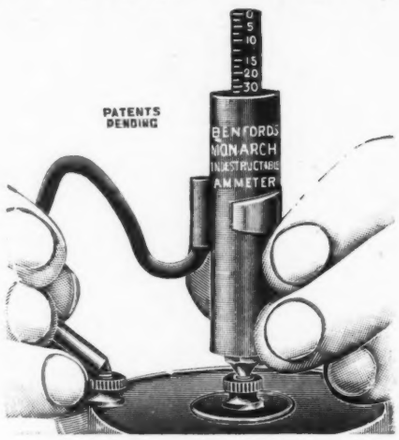


ELECTRICALLY OPERATED ICE-CREAM FREEZER

The motor is connected to the machine by silent chains to inclosed gears below the base. The freezing chamber is of German silver and is provided with a scraper and gears which revolve in opposite directions. The base of the chamber is hollow and contains the freezing mixture. The ice-cream freezer is being made by the Emery Thompson Machine & Supply Company, 235 East Forty-first Street, New York.

Small Tubular Ammeter

An ammeter for measuring the current of batteries and other circuits up to 30 amp is shown in the accompanying illustration. According to the manufacturers, the device is very rugged and practically indestructible. When connected to a circuit the current is read by means of the small projection or tongue shown in the



TUBULAR AMMETER

illustration. The bottom of the device forms one contact while the other contact is connected to a cord. A cap is provided which is placed over the top of the instrument when not in use. The instrument is small enough to place in one's vest pocket. It is being placed on the market by the Benford Manufacturing Company, Mount Vernon, N. Y.

Portable Air Compressor for Inflating Tires

A small motor-driven air compressor designed especially for inflating automobile tires has recently been developed by the Brunner Manufacturing Company, Utica, N. Y. Use is made of a two-cylinder compressor, and the cylinders are 1.625 in. by 1.5 in. Each piston

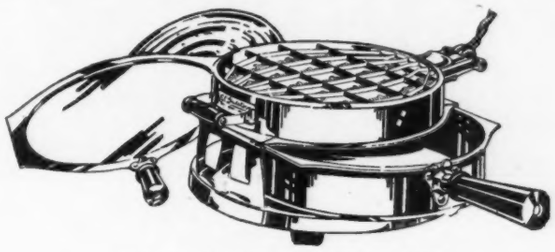
PORTABLE MOTOR-DRIVEN COMPRESSOR

is fitted with three ground metal rings. The motor, the air compressor and a small cast-iron tank are mounted on a cast-iron base. The base is fastened to two iron wheels which are under the motor and a swivel cushion-tired wheel under the compressor. The handle is 30 in. high and is provided with heavy hooks for hanging the hose and cord. The length of the apparatus is 20 in., the height 15 in., and the width 15.5 in. It weighs 110 lb. A 0.25-hp motor is employed to operate the machine, and for alternating-

current outfits a Wagner repulsion-induction-type motor is used, and for direct-current sets a compound-wound Robbins & Myers motor. The motor is connected to the compressor by means of a cloth pinion.

Small Electrical Stove

The "El Grilstovo," illustrated herewith, has recently been developed by the Hotpoint Electric Heating Company, Ontario, Cal., and will be a feature of a special selling campaign which will be inaugurated by the above



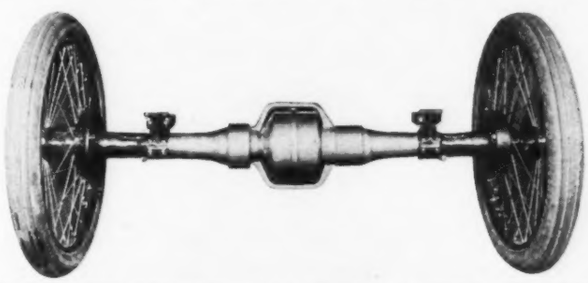
ELECTRICALLY OPERATED STOVE

company during the week of May 3-8, which will be called "Hotpoint week." The stove can be connected to any lamp socket, and cooking can be performed above and below the coils at the same time. The stove is equipped with a deep under-dish, as shown, and a removable broiling grid. Use is made of a reflector to concentrate the heat upon the food when only one operation is performed. The stove can be utilized as a table as well as a kitchen appliance. The diameter of the top is 7.25 in., the height 4 in., and the diameter of the base 9 in. The device is of pressed steel and is finished in polished nickel.

Low-Priced Light-Weight Electric Passenger Vehicle

The Dey Electric Vehicle Syndicate, 45 Broadway, New York, the formation of which was noted in the ELECTRICAL WORLD of Nov. 7, 1914, has been working on a new type of electric vehicle, the feature of which is the motor, which is in the rear axle and is equipped with revolving field and revolving armature. The axle is an invention of Mr. Harry E. Dey, who is engineer of the syndicate. Mr. Max E. Schmidt is chairman, Mr. H. W. Hillman treasurer, and Dr. C. P. Steinmetz consulting engineer of the syndicate.

The field of the motor turns one of the rear wheels of the vehicle and the armature turns the other; hence



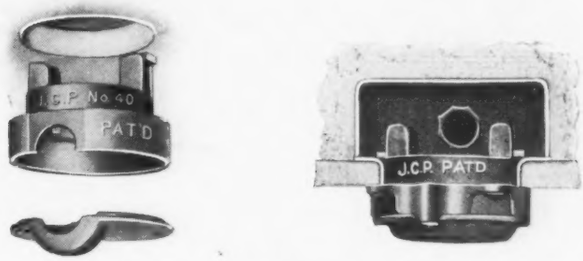
MOTOR WITH REVOLVING ARMATURE AND FIELD ATTACHED TO REAR AXLE

the motor acts as its own differential. The rear axle and motor are shown in the accompanying illustration. With this arrangement considerable space underneath the car is saved and is available for the battery. A new type of control has been designed for use with the car which prevents to a considerable extent the retardation of speed when climbing hills. When going down hill the motor acts as a generator at three different speeds, thus acting as a brake and recharging the battery.

The axle and motor were originally fitted to a Babcock victoria, but a new car is now being built which will be completed within the next month. The new car will seat three passengers and will weigh approximately 1100 lb. The body will be of a light material and of stream-line design. The car will be able to cover about 100 miles on one charge.

Outlet-Box Attachments

The fitting shown in Fig. 1 is designed for connecting iron conduit to an open outlet-box cover plastered in the ceiling. The device illustrated in Fig. 2 is designed for connecting National Metal molding to an open outlet-box

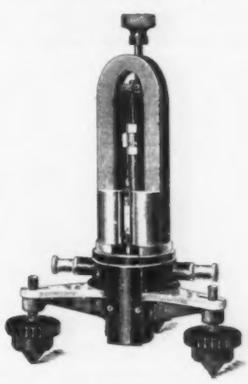


FIGS. 1 AND 2—ATTACHMENTS FOR OUTLET BOXES

cover. The fitting takes any of the covers used on the molding boxes made by James C. Phelps, Springfield, Mass., the manufacturer of the two above attachments. It is said to be useful for extending metal molding from outlet boxes. These fittings have been approved by the National Board of Fire Underwriters.

Vibration Galvanometer

The vibration galvanometer shown herewith is of the moving-coil or D'Arsonval type and is a recent development of the Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, Pa. The moving system consists of a solid coil of wire whose cross-section is rectangular. A mirror is fastened rigidly to the coil. Rough adjustment is obtained by turning the thumb-screw shown at



VIBRATION GALVANOMETER OF D'ARSONVAL TYPE

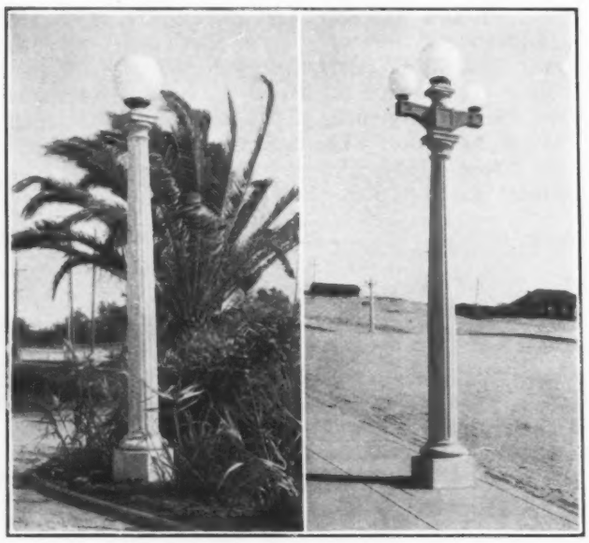
the top of the instrument, which causes the fret to move up and down along the upper suspension, thereby causing the effective length of the suspension to be changed. To secure fine adjustment the tension of the suspension is altered by means of a thumb-screw at the back of the

instrument. The galvanometer is most conveniently read with a lamp and scale, projecting an image of the bright lamp filament upon the scale and noting the broadening of the image when the system vibrates. The width of the band of light measures the amplitude of vibration of the system, and hence the magnitude of the current in the galvanometer circuit. According to the manufacturers, one of the valuable characteristics of the instrument is its lack of response to the harmonic components of the exciting current. As a result it may be employed on measuring circuits where the source of emf is far from being a sinusoidal one.

Concrete Lighting Standards

A reinforced-concrete lighting standard of attractive design and appearance is being installed in a number of California cities, including the beach resorts, where metal standards have suffered severely in the past owing to the action of salt air. Fig. 1 shows a single-lamp standard in the design of which the true proportions of the Doric column have been followed. It is provided with either a square or octagonal base. Fig. 2 illustrates a three-lamp standard, using the same type of shaft.

The standards are built in three parts, shaft, base and capital being cast separately by the centrifugal process. In the employment of this process a wooden or metal mold of the desired outline and dimension is



FIGS. 1 AND 2—SINGLE-LAMP AND THREE-LAMP STANDARDS

made in two or more parts. Where steel reinforcement is required the steel pieces are "built up," placed in the mold, and properly supported from the wall on a dead center. The sections of the mold are then securely clamped together, and the desired mixture of gravel, sand and cement is introduced at the end. The mold with its contents is then placed in a specially designed machine and revolved at high speed, the rate of speed depending on the diameter of the mold. A natural selection of the heavier particles of the aggregate results from this operation, and they are forced to the outside.

After revolving thirty minutes the mold is withdrawn from the machine and allowed to stand for twenty-four hours before the contents are removed, when it can be safely handled without fear of injury to the surface. A further open-air curing, keeping the product moistened, completes the process. At first thought it might seem that the larger particles only would be forced to the outside, leaving a rough surface. However, all voids are filled and the resultant product has a hard and smooth surface. The surface is similar to cut and polished stone, it is asserted, hence the

FIG. 3—CONCRETE POLES USED IN CONSTRUCTION OF OPEN ELECTRIC-RAILWAY DEPOT

trade name "marbelite." The size of the hollow core depends on the quantity of material placed in the mold.

While this process may be employed for the manufacture of a large variety of concrete products, it is especially suitable for making reinforced-concrete electroliers. In the standards shown, the base, shaft and capital are cast separately and when erected are securely anchored to a concrete foundation by twisted-steel reinforcing bars. These standards are being manufactured by the American Cement Products Company, 517 Union Oil Building, Los Angeles.

Combined Regulator and Cut-Out for Automobile Lighting Outfit

A device designed to regulate the output of an automobile generator, regardless of the speed at which the armature revolves, and to break the circuit between the generator and battery when the generator is not running, thus preventing the discharge of the battery back to the generator, is being made by the Carleton Company, 170 Summer Street, Boston, Mass. It consists of two armatures, a shunt and a series coil, and a resistor which is connected to the shunt field by means of the vibrating armature. Use is made of double sliding contacts, one contact being of carbon and the other of bronze. When the generator is started the shunt coil is energized, and it pulls in the carbon-tipped armature,

COMBINED GOVERNOR AND CUT-OUT

thus throwing the series coil into the circuit and completing the battery circuit. When the generator starts or slows down sufficiently a spring opens the circuit. When the current in the series coil rises to the point determined for regulation the vibrating regulator cir-

cuit is opened and the resistor is connected in series with the shunt field, causing the charging current to drop sufficiently to allow the regulator to return to its normal position, thereby short-circuiting the resistor. The device weighs about 1 lb. and measures 2.75 in. by 2.5 in. It is entirely inclosed by a stamped-steel case, which is fastened to a heavy fiber base.

Lamp Fixture with Collapsible Shade

The lighting fixture shown in the accompanying illustrations is equipped with a collapsible shade, the shade being folded as illustrated in Fig. 1 and extended as shown in Fig. 2. The collapsible feature is especially

FIG. 1—SHADE COLLAPSED

convenient for packing purposes, and as a result the unit can be sold at a lower price, it is declared, than would otherwise be possible. The shades are of various kinds of cretonnes and are finished in beautiful designs.

FIG. 2—SHADE UNFOLDED

At a distance of 15 ft. or 20 ft., the effect, it is asserted, is similar to that obtained with the more expensive glassware. The fixture is being made by Rose Brothers & Company, manufacturers of umbrellas and parasols, Lancaster, Pa.

Demountable Switch

With the "bulldog" demountable safety switch, shown in the accompanying illustration, the ends of the branch-circuit cross-bars of a panelboard are utilized as the stationary elements of contact. The movable parts of the switch comprise four leaved-copper brushes, each

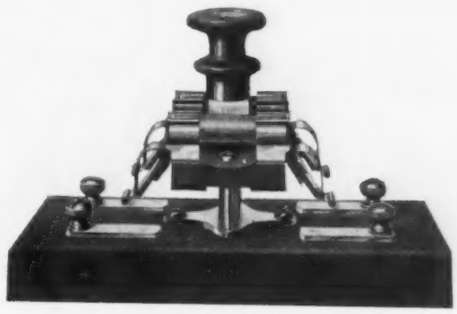


FIG. 1—SWITCH IN OPEN POSITION

of which is protected by a special copper arcing tip and a pair of fuse receptacles. All of the parts are in turn mounted on an insulating block that is actuated by means of an insulating handle. The latter is expanded at its outer end to accommodate a recessed face into which a paper disk bearing the name or number of the circuit controlled may be pressed. The moving parts are attached to a heavy V-shaped spring, which acts with a pair of dogs which slide along the central

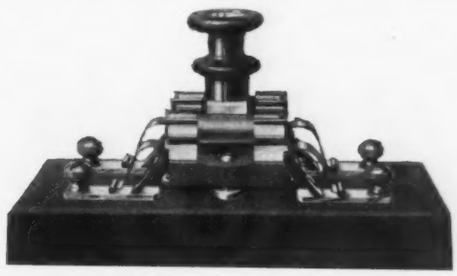


FIG. 2—SWITCH IN CLOSED POSITION

post shown in Fig. 1. This post rises from a metallic base which is fastened to the panelboard by means of two machine screws. This fastening constitutes the demountable feature, as it requires only a moment's work to loosen the pair of screws and remove the working parts. It is thus possible to install the panelboard while a building is undergoing construction, and later attach the switches after the plastering and other dirty work has been completed. The spring system

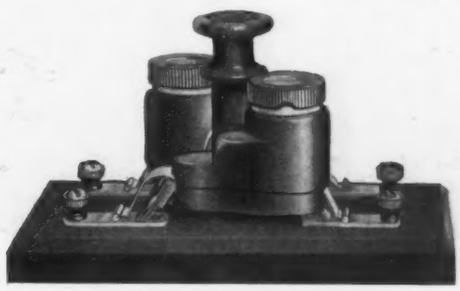


FIG. 3—SWITCH WITH PLUG FUSES

is designed to produce a strong snap action in opening or closing the switch. The switches are being made for use with either the cartridge-type fuse or plug fuses by the Mutual Electric & Machine Company, Wheeling, W. Va.

Pole-Line Equipment

The accompanying illustrations show two new pole-line devices which have recently been placed on the market by the St. Louis Malleable Casting Company, 7700 North Broadway, St. Louis, Mo. Fig. 1 shows a malleable-iron pole saddle for attaching and supporting cross-arms to metal or concrete poles. The saddle may be attached by turning up the two nuts with the fingers. When weight is applied to the cross-arm the saddle holds firmly under the application of the downward pressure, since the more weight applied to the cross-arm the tighter the saddle clings to the pole. The straps and hinges are made in double pairs so that, should one pair break, the other pair alone is able to carry many times the load required.

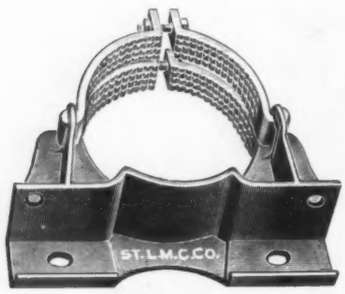


FIG. 1—POLE SADDLE

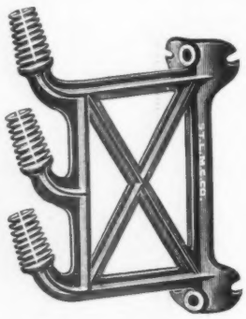


FIG. 2—EXTENSION BRACKET

Fig. 2 shows a form of pole bracket designed for use in cities where local rules require that wires shall be 14 in. from the center of the pole. The ears, which are curved to fit the surface of the pole, are adjustable to practically any diameter.

Battery-Operated Lantern

The lanterns shown in Figs. 1 and 2 are operated by ordinary dry cells, which are inclosed in polished-oak cases with nickel-plated fittings. One cell is employed with the lantern shown in Fig. 1 and two cells with that shown in Fig. 2. The former is 3.25 in. by 3.25 in. by 8 in. in size and is equipped with a 1.5-volt lamp. The latter is 3.25 in. by 6 in. by 8 in. in size and is equipped with a 2.8-volt lamp. Both lanterns, it is claimed, will throw the light a distance of about 100 ft.

FIGS. 1 AND 2—BATTERY-OPERATED LANTERNS INCLOSED IN OAK CASES

According to the statement of the concern manufacturing the lanterns, the Illuminating Electric Manufacturing Company, 236 South Third Street, Philadelphia, Pa., the larger lantern will burn for more than 100 hours with one battery and the smaller for more than fifty hours with one battery.

Electrician's Pliers

Mathias Klein & Sons, 562 West Van Buren Street, Chicago, Ill., manufacture the two recently developed pliers illustrated herewith. The tools, it is asserted,

FIG. 1—NEEDLE-NOSED PLIER

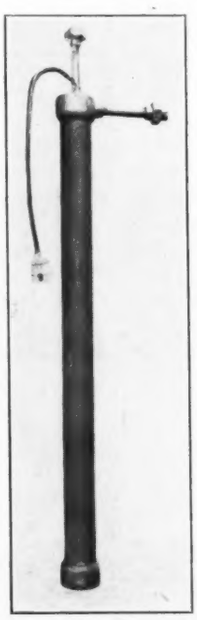
will effect a clean cut without breaking silk-covered wire. The pliers are of the "millinery" type and are provided with safeguards against the possibility of the wire be-

FIG. 2—BLUNT-ENDED PLIER

coming caught in the joint. This safety feature is accomplished by means of a lap-joint construction. The pliers are of tool steel and are hand-forged.

Electric Water Heater

The device shown herewith is 3 in. in diameter and 30 in. long, and is used for heating water. It is designed to give one or three gradations of heat as desired, and may be controlled by a switch which is connected as shown or by a remote-control switch. The device is made with different ratings so that it will heat from 30 gal. to 30,000 gal. of water a day. It is being made by Apfel & Jansen, 1626 Fourth Avenue, Seattle, Wash.



ELECTRIC IMMERSION WATER HEATER

CURRENT NEWS SECTION

"Electrical Prosperity Week"

"Electrical Prosperity Week" has been selected as the most appropriate title for the national electrical celebration to be held during the first week in December. The full conclusions of the March 24 meeting of the executive committee, held at the Railroad Club, New York, were not announced when last week's issue of the ELECTRICAL WORLD went to press. The executive committee to guide the campaign is as follows: Mr. A. W. Burchard, vice-president General Electric Company, chairman, alternate, Mr. F. H. Gale, advertising manager General Electric Company; Mr. Gerard Swope, vice-president Western Electric Company, alternate, Mr. E. W. Rockafellow, sales department Western Electric Company; Mr. J. R. Strong, president Tucker Electrical Construction Company, alternate, Mr. George Weiderman, George Weiderman Electric Company, Inc.; Mr. Frank W. Smith, vice-president United Electric Light & Power Company, New York, alternate, Mr. George Williams, Henry L. Doherty & Company; Mr. Hugh M. Wilson, vice-president McGraw Publishing Company, alternate, Mr. Frank B. Rae, Jr., *Electrical Merchandise.*

Much discussion took place at the meeting on the question of the date. Those who favored a time in the fall argued that that is the most advantageous season, although they admitted that a tremendous amount of work would have to be done to make the celebration successful. They also held that enthusiasm had already been aroused and that postponement would cause a loss of interest. Those who favored a date in the spring argued that central stations would be in a better position at that time to conduct house-wiring campaigns and to render aid. Finally Mr. Frank H. Gale suggested that the week to include Dec. 1 be selected. Mr. Frank W. Smith, representing central stations, seconded the motion, and the vote was unanimous.

Among the various designations for the week in addition to "Electrical Prosperity Week," which was selected, were "National Electric Week," "National Electrical Prosperity Week," "National Electrical Prosperity Celebration," "National Electrical Progress Week," and "Electrical Development Week." A committee of three made the final decision.

As stated in the ELECTRICAL WORLD of March 27, 1915, the responsibility is placed upon the general manager of the Society for Electrical Development, Mr. J. M. Wakeman, and his staff. Mr. H. W. Alexander, manager of the department of publicity, will have charge of the publicity work. Mr. Wakeman was directed to prepare a budget of the expense for submission to the executive committee at its meeting on April 7. At this meeting names of fifty local members of committees to handle the campaign at different geographical centers will be considered.

Among the plans under consideration are a national advertising campaign in magazines, local newspaper advertising in each locality, special film productions for motion-picture theaters, poster displays, electric signs, billboards and electric-railway cards. A motion-picture film showing the history of development of electrical energy has been suggested. Special attractions will be offered by the Panama-Pacific Exposition during the week.

Report of Committee on Wiring of Existing Buildings

A meeting of the committee on wiring of existing buildings of the National Electric Light Association was held on March 24, at the Engineers' Club, New York City. Mr. Hale reported in regard to plugs and receptacles the information given at the meeting of the manufacturers of those articles, and that the underwriters had referred the suggested changes in the rules to provide for a classification of plugs and receptacles to a committee for further action. General satisfaction was expressed at the action of the underwriters in continuing the sub-committee for further investigation of bare concentric wire, as it was the feeling of the N. E. L. A. committee that this would broaden the field and start investigation not only of bare concentric wire itself but of the other similar systems which might reduce the cost of wiring without reducing the safety.

Several members announced that they intended to make installations of bare concentric wire as soon as the wire and fittings could be secured, and it was stated that some lots of the wire had already been shipped or would be shipped in a day or two.

It was voted to hold another meeting on May 7 or 14 at Baltimore, Md., with a view to preparing a supplementary report for the convention in regard to plugs and receptacles and on further experience with bare concentric wire, as there would be a great deal on both of these subjects that could not be given to the printer in time for the San Francisco report and yet which should be laid before the convention.

Standardization of Plugs and Receptacles

A meeting of the manufacturers of plugs and receptacles working in conjunction with the committee on wiring of existing buildings of the National Electric Light Association was held at the Engineers' Club, New York, March 23, 1915. The makers of the straight-pull type of plugs and receptacles announced that they were making progress toward an agreement of standardization and that they would be ready to report in the course of two or three weeks as to what agreement they might make and on what terms the holders of patents might be prepared to issue licenses. The manufacturers of the angle-pull or rock-out type also stated that they were taking steps toward an agreement for standardization and hope to be able to report in a similar way and to make an announcement in the course of two or three weeks. The straight-pull-type manufacturers had previously selected Mr. Sargent, of the General Electric Company, as their chairman, and at this meeting the manufacturers of the angle-pull type selected Mr. R. B. Benjamin as their representative.

Mr. Hale, of the N. E. L. A. committee on wiring of existing buildings, called the attention of the committee to the fact that if the terms of licenses were considered unfair by any manufacturer, whether reasonably or unreasonably, this would necessarily prevent standardization on any single type, at least until the patent had expired. The meeting adjourned with the understanding that the two chairmen above mentioned would

as soon as practicable notify Mr. Hale as to what action had been taken toward standardization and under what terms the licenses for the two types would be issued, and that a meeting would be called again by Mr. Hale as soon as he should hear from them.

It is very probable that in the course of the next few months an agreement on a straight-pull type of plug and receptacle and on an angle-pull or rock-out type of plug and receptacle may be reached, which if the license terms are reasonable will reduce the number of types to two, instead of the fifteen or twenty which are now in use, though for some time the old types may continue to be manufactured and used to a small extent.

The possibility of reducing the number of types to one only was discussed, but the comparative advantages of concealed contacts, which are most easily available with the straight-pull type, as compared with the more exposed contact but ease of disconnection of the angle-pull type, are still so largely a matter of debate that a final decision between these two types will probably not be arrived at for some time and certainly will not be reached unless holders of patents of the type that is finally to be established shall make unusually fair license terms.

Minnesota Electrical Association

From the standpoint of attendance, the eighth annual convention of the Minnesota Electrical Association, held at the St. Paul Hotel, St. Paul, Minn., March 23, 24 and 25, was the largest meeting of the association in recent years. About 150 members and guests were registered, and at the banquet nearly 300 persons were in attendance. Following an address of welcome by Mayor Winn Powers of St. Paul, the technical program of the convention was presented as follows: President's address by Mr. R. E. Brown of Mankato; report of secretary and treasurer, Mr. F. A. Otto of St. Paul; "Oil Engines for Central Stations," by Mr. C. G. Sprado of Milwaukee, Wis.; "Financing Problems of Public Utilities," by Mr. W. H. Hodge of Chicago; "Incandescent-Lamp Developments," by Mr. Ward Harrison of Cleveland, Ohio; "Work of the University of Minnesota Extension Bureau," by Prof. G. D. Shepardson of Minneapolis; "Central-Station Diversity Factors," by Prof. W. T. Ryan of Minneapolis; "The Watt-hour Meter," by Mr. W. L. Wadsworth of Minneapolis; "Resuscitation and First Aid for Electric Shocks and Burns," by Dr. E. H. Whitcomb of St. Paul; "Proper Electrical Installation," by Mr. O. Frykman of Minneapolis; "Incandescent Lamps and Lamp Testing," by Mr. Preston S. Millar of New York City; "Friendship as a Factor in Load Building," by Mr. W. N. Matthews of St. Louis, Mo.; "High-Tension Outdoor Substations," by Mr. H. W. Young of Chicago, and "Achievements in Accident Prevention," by Mr. D. D. Lescohier of St. Paul The result of the election of officers announced at the last session of the convention was as follows: President, Mr. T. D. Crocker of Minneapolis; first vice-president, Mr. J. C. Bang of Madison, Minn.; second vice-president, Mr. J. W. Peterson of Fergus Falls; secretary and treasurer, Mr. F. A. Otto of St. Paul; executive committee, Messrs. R. E. Brown of Mankato, R. F. Pack of Minneapolis, and Ludwig Kemper of Albert Lea. At the banquet given by the attending jobbers and manufacturers on the evening of March 24 short speeches were delivered by Mayor Powers, Mr. R. F. Pack of Minneapolis, Mr. Paul Doty of St. Paul, Mr. W. N. Matthews of St. Louis, and Mr. Preston S. Millar of New York. Association members who have attended the meetings of the society for several years commented upon the educational character of the manufacturers' and jobbers' exhibits at the hotel, and the attractiveness of the exhibits was attested by the fact that the exhibit rooms were generally well filled by central-station men.

Changes in National Electrical Code

While a number of changes were made in the National Electrical Code by the National Fire Protection Association at its biennial meeting in New York City on March 24 and 25, many of them did not alter the principle of the rules but merely brought out more emphatically what was formerly obscured in fine-print notes or minor paragraphs. New rules were inserted to cover gas-filled lamps and electrical installations in garages, while a number of new sections were added to existing rules on transformers, cabinets and insulating joints.

Ground connections are now required on the bases of machines operating at 550 volts or less, and on the cases or frames of transformers used exclusively to supply energy to switchboard instruments. However, if the transformers are installed and guarded as required for the higher-voltage circuit connected to them, their cases need not be grounded.

The leads or branch circuits of varying (or variable) speed motors must be designed to carry 180 per cent of the thirty-minute current rating of the motor when connected with rolling tables, 150 per cent of the rating when connected with hoists, rolls, ore and coal handling machines, and 120 per cent when connected with freight and passenger elevators, shop cranes, tool heads, pumps, etc. Small motors may be grouped under the protection of a single set of fuses, not to exceed 10-amp rating, provided the load does not exceed 660 watts. The continuous current-carrying rating of a time-limit circuit-breaker protecting an alternating-current motor requiring a large starting current need not be greater than 125 per cent of the motor rating, provided that the time-limit device is capable of preventing the breaker opening during the starting period.

Multiple-conductor cables installed outdoors and not protected by service cut-outs and switches must be supported by strain insulators installed not less than a foot from all woodwork and in turn attached to petticoat or strain insulators. Metallic conduits containing service wires must be insulated from all metallic work on or within buildings, or they must be grounded on the street side of the meter. The ground connection must be independent of and in addition to any other ground wires from within the building. Copper ground wires as small as No. 6 B. & S. gage are now permitted where the largest wire in the conduit is No. 0 B. & S. gage or smaller.

Former limitations to a private generating plant supplying energy to other buildings than the one in which it is installed have been removed by allowing conductors to be buried under 2 in. of concrete under buildings, or back of 2 in. of concrete or brick within a wall. Factory yards and buildings under single occupancy or management are exempt from the rule limiting the transmission of energy from a private generating plant to adjoining buildings.

The permissible current-carrying ratings of 300,000, 400,000 and 500,000-circ. mil copper wires and cables of 98 per cent conductivity have been reduced to 270 amp, 330 amp and 390 amp respectively with rubber insulation, while 500,000-circ. mil wires and cables with other than rubber insulation are allowed to carry 590 amp.

Power has been given to the committee on grounding of low-potential systems to insert a paragraph in the 1915 code to the effect that Rule 19, Section a, will not

apply to the grounded conductor of a low-potential system where one line is permanently grounded, and provided that in addition to the general system grounds each installation shall have its own ground connection equal in size to the largest wire in the installation.

Single-pole switches may be employed in three-wire systems where the neutral is permanently grounded and the load is supplied at the voltage between either outer wire and neutral. Cabinets and cut-out boxes must be made of metal when used with metal conduit, armored cable or metallic molding. To insure safety to life, constant-current systems will not be allowed inside buildings except by special permission.

Automatic cut-outs have been prohibited in grounded conductors or ground wires. When service switches are installed inside buildings, cut-outs must be employed to protect them unless they are of the knife-blade type and are inclosed in an approved box or cabinet, under which condition the switch may be placed between the source of supply and the cut-out. Link fuses may be used only when mounted on approved bases, which, except on switchboards, must be inclosed in approved cut-out boxes or cabinets. The committee on cabinets is drafting a rule for the 1915 code which will prohibit connecting receptacles for attachment plugs rated at over 660 watts each to branch circuits.

Service switches must indicate plainly whether the circuit is closed or open. A single circuit having a connected load of more than 1320 watts shall not be inclosed in metal molding. This rule is intended to permit 1320 watts being supplied on each side of a three-wire circuit. Slow-burning insulation may be used inside conduits in permanently dry locations where excessive temperatures are present, provided that special permission in writing be given in advance.

A turn of 90 deg. in the conduit system is no longer recommended as a satisfactory support for vertical risers, this method having been superseded by another recommending approved clamping devices constructed of or employing insulating wedges inserted in the ends of the conduit.

Rule 26, Section x, relating to the installation of wires in fixtures, has been amended to require flexible conductors in chain-suspended fixtures.

A new section specifying the size of conduit for installations of wires and cables has been added to the code. The new rules will permit installing multiple taps having opposite polarity in switch and junction boxes.

Considerable discussion arose over the advisability of employing insulating joints between fixture canopies and outlet boxes.

In fairness to manufacturers and for technical reasons, it was decided to refer Rule 30, Section a, to a special committee, which will report in 1917.

Power has been given to a special committee to change Rule 31, Section c, so that keyless-type sockets controlled from convenient cabinets will be required where specially inflammable stuff or floating fragments of combustible materials are present. Approved portable cord may be used to supply energy to portable lamps and other devices in show windows for exhibition purposes.

A new rule, No. 35, covering gas-filled incandescent lamps, permits units rated at 1320 watts (or thirty-two sockets or receptacles) to depend on the same cut-out for protection if wire equal in size to No. 14 B. & S. gage is carried directly into keyless sockets or receptacles. Where a single socket is connected to a circuit, the cut-out must limit the power delivered through the circuit to the rating of the socket or receptacle. Gas-filled lamps are not allowed to be used in show windows or other locations where they are liable to come in contact with inflammable material. They may be used in such positions, however, when supported in approved fixtures no exposed part of which attains a temperature exceeding 200 deg. Fahr.

Gas-filled lamps rated above 100 watts and equipped with shades or other inclosures above the socket must not be used with fiber-lined brass-shell sockets of either the medium-base or Mogul-base types; units rated above 200 watts must not be used in medium-base sockets, and those rated above 1500 watts must not be used in the Mogul-base sockets. Within buildings or where the temperature to which lamp fittings may be subjected may exceed 120 deg. Fahr. fixtures must be wired with conductors having approved slow-burning insulation or asbestos covering.

A number of changes and additions were made in the rules affecting theater electrical equipment. Among these were the following: Lamp dimmers must be de-energized when the switch controlling the circuit is open; not more than thirty-two receptacles can be dependent on one cut-out; dressing-room lamp guards must be sealed or locked in place; motion-picture booths must be ventilated by a fan capable of exhausting 50 cu. ft. of air per minute, the motor being connected so that it will not be in the path of the heated gases; motion-picture equipments for homes, lecture halls, etc., must not require more than 660 watts.

The thickness of insulation, voltage tests and minimum insulation resistance of rubber-covered wire in the zero to 600-volt class are to be in accordance with the table published in Rule 50, Section e, which was formerly intended for the 600-volt to 7000-volt class.

With barriers of approved design and material the minimum separation between parts of opposite polarity may be as specified in Table IV of the code.

In the "Cabinet and Cut-out Box" section changes have been made to the effect that wood and composition cabinets cannot be used with metal conduit, armored cable or metal molding. Only a skeleton of the rules regulating the construction of cabinets and fixtures will be published in the code as separate pamphlets will be devoted to each of these subjects.

The socket committee has under consideration a rule requiring that all medium-base sockets be designed for 660-watt rating. This has been considered necessary as so many electric heating appliances are being adapted to receptacles designed for only 250-watt loads. This subject aroused considerable discussion at the recent New York meeting. It was argued that requiring 660-watt sockets in place of 250-watt sockets will greatly increase the cost of wiring buildings. A central-station man was quoted as saying that 75 per cent of socket troubles have been caused by opening socket switches when heating devices have been connected thereto. Exception to this man's statement was taken by the chairman of the meeting, who declared that reports from several large central stations show only a few cases of troubles having occurred from breaking overloaded circuits. Changes in rules on rubber-covered wire require that No. 6 B. & S. wire and larger be double-braided. A skeleton of these rules will appear in the code, and a separate pamphlet will be devoted to the entire subject.

Rules regarding marine installations and equipment were referred to a committee which will confer with a similar committee of the American Institute of Electrical Engineers to harmonize rules for the 1915 code.

A new rule has been added to the code to regulate the installation of electrical equipment in garages in which two or more vehicles are kept. These rules do not apply to garages used exclusively for electric vehicles. Metal conduit or approved armored cable is required for all wiring except pendent lamps or portable connections, and metal molding is allowed only in offices or showrooms. The rules are intended to prevent

arcing points being less than 4 ft. above the floor. To fulfil this condition flexible conductors must be designed for rough usage and arranged so that in case they pull apart the arc will occur not less than the prescribed distance from the floor. In case motors, generators and arcing points on the switchboard cannot be installed to comply with this requirement, they must be completely inclosed.

Meeting of N. E. L. A. Commercial Section Executive Committee

The executive committee of the Commercial Section of the National Electric Light Association met at the association headquarters in New York on March 27. The following were present: Messrs. Douglass Burnett, chairman; J. F. Becker, N. H. Boynton, E. A. Edkins, F. H. Gale, J. D. Israel, T. I. Jones, J. C. McQuiston, L. R. Wallis, George Weiderman, C. A. Littlefield, secretary, and Miss Burkhalter, assistant secretary. Messrs. F. R. Jenkins and R. R. Young were present by invitation.

Mr. Burnett reported that the executive committee of the main body voted at its March meeting to transfer the subscription work on *Rate Research* to the Commercial Section. The editing and publication work will be continued in Chicago under the direction of Mr. W. J. Norton, but the business and subscriptions will be handled by the Commercial Section at New York.

The executive committee of the main body, Mr. Burnett reported, has decided that, as heretofore, the lamp committee report shall be presented at one of the commercial sessions at the convention. He also reported that when he asked Mr. Frank W. Smith, chairman of the lamp committee, about the subject of standard lamp voltages Mr. Smith said that the committee had already decided to give more attention to that matter this year. The work of the lamp committee as planned by it therefore coincides with the suggestions and recommendations which Mr. Burnett has discussed with lamp manufacturers.

The meeting held in Atlanta, Ga., on Feb. 23, by sales managers of Southern hydroelectric properties was discussed. It was decided to communicate with Mr. W. R. Collier, of the Georgia Railway & Power Company, and to arrange with him for the appointment of a hydroelectric commercial committee of the Commercial Section, to be composed of about five members. This committee will try to show representatives of hydroelectric companies why they should organize as a part of the Commercial Section. The Southern hydroelectric properties are seeking to standardize their methods.

Mr. E. A. Edkins reported for the publications committee that the store-service campaign will be ready for presentation at the San Francisco convention. The committee has decided to issue a new booklet on industrial lighting.

Mr. Edkins said that he had received a letter from Mr. C. J. Russell, chairman of the handbook committee, stating that that committee would be very glad to receive instructive criticism and practical suggestions as to the kind of material salesmen need, and suggesting that some of the material on wiring prepared by the publications committee might properly be incorporated in the handbook. The report of the publications and handbook committees was accepted with a vote of thanks to Messrs. Edkins and Russell.

Secretary Littlefield read a report of Mr. John G. Learned, chairman of the Commercial Section membership committee, showing 865 new members since Jan. 1.

The report of Mr. M. E. Turner, chairman of the committee on commercial department terminology, was presented by Secretary Littlefield. This report suggested standardization of titles of commercial department representatives. Great interest was expressed by the committee, and it was decided to ask Mr. Turner to write to companies with which he has corresponded and see if they would agree to accept the proposed standardization of titles, and to include the replies with the report at the convention.

A letter from Mr. R. S. Hale, chairman of the committee on wiring of existing buildings, was read by Mr. Littlefield. The work of this committee has not been completed, but Mr. Hale submitted part of the report. It was voted to print the different parts of the report as they are completed.

Mr. Jenkins, chairman of the committee on education of salesmen, presented copies of the prospectus outlining the proposed course on sales engineering. It is intended that the course shall be self-supporting. Copies of the prospectus will be sent immediately to member companies, which will be urged to appoint leaders and organize classes. Mr. Jenkins has taken up the matter with Messrs. J. F. Gilchrist and E. W. Lloyd, who stated that the Central Station Institute of Chicago will be glad to co-operate with the Commercial Section.

After lunch at the Engineers' Club Mr. Young presented the report of the committee on merchandising and recent development of electrical appliances. The report was accepted with a vote of thanks to the committee for its excellent work, and it will be printed. It was decided that additional copies will be printed for sale after the convention.

Mr. Russell, chairman of the power sales bureau, wrote suggesting that the different committees of the bureau be continued during the next association year with very little change. The report was approved.

The publications committee will arrange for an exhibit at the convention. The next meeting of the executive committee will be held in San Francisco on June 7.

Ohio New-Business Men Meet at Dayton

At the meeting of the committee on new-business cooperation of the Ohio Electric Light Association, held at Dayton, Ohio, March 17, the fourth session of its kind to be held during the season of 1914-15, the registered delegates numbered 112. Following an address of welcome delivered by Mr. F. M. Tait, president of the Dayton Power & Light Company, the following papers were presented: "Central-Station Advertising," by Mr. E. R. Kelsey, advertising manager of the Toledo Railways & Light Company; "Salesmanship," by Mr. R. H. Grant, sales manager of the National Cash Register Company of Dayton; "Application of Electric Drive in Woodworking Shops and Disposal of the By-product," by Mr. T. F. Jones, of the Wagner Electric Manufacturing Company, St. Louis, Mo., and "Co-operation of Electric-Motor Manufacturers with Central Stations to Secure Available Motor-Service Business," by Mr. W. H. Patterson, of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. To the helpful ideas which the papers and addresses contained many "sales helps" were added during the open discussion, led by Mr. Thomas F. Kelly, sales manager of the Dayton Power & Light Company.

A banquet and rejuvenation given in the evening by the Dayton Jovian League brought out a lively crowd of 215 electrical men, who listened to short after-dinner talks by Col. C. V. Hard, of Wooster, on "The Ohio Electric Light Association"; Mr. W. W. Freeman, Union Gas & Electric Company, Cincinnati, on "The Public Be Pleased"; Mr. H. M. Waite, city manager of Dayton, on "The Commission Form of City Government"; Mr. S.

G. McMeen, of Columbus, on "Service First"; Mr. F. H. Rike, of Dayton, on "Citizenship and the Work of the Greater Dayton Association"; Mr. D. L. Gaskill, of Greenville, on "The Small Electric-Light Plant," and Mr. A. E. Loeb, of Columbus, on "The Jovian Order." Mr. F. M. Tait, of Dayton, was toastmaster. Twenty-five candidates were initiated at the rejuvenation which followed the banquet.

A. I. E. E. Meetings

A meeting of the American Institute of Electrical Engineers will be held in the Engineering Societies Building, New York, on Friday, April 9, 1915, at 8:15 p.m. The subject of the meeting, radiotelegraphy, will be briefly introduced by Dr. John B. Whitehead, of Johns Hopkins University. A paper will be presented, entitled "Continuous Waves in Long-Distance Radiotelegraphy," by Mr. L. F. Fuller, and it is expected that another paper covering other phases of the same general subject will also be presented.

At the close of the technical session a smoker will be held and light refreshments served in the adjoining room on the fifth floor.

Pittsburgh Meeting

A meeting of the Institute will be held in Pittsburgh, Pa., on Thursday and Friday, April 15 and 16, 1915, under the auspices of the Pittsburgh Section and the industrial power committee. The convention headquarters will be at the Fort Pitt Hotel, where the technical sessions will also be held. The meeting is to be opened by Mr. J. W. Welsh, as chairman of the Pittsburgh Section, and the introductory address will be delivered by Mr. David B. Rushmore, as chairman of the industrial power committee. President P. M. Lincoln will then address the meeting.

The following papers will be read: "Industrial Control in the Foundry," by Mr. R. H. McLain; "Mill Controllers," by Mr. H. F. Stratton; "Steel-Mill Controllers from the Operator's Standpoint," by Mr. James S. Riggs; "Control of Direct-Current Hoists in Iron and Steel Mills," by Messrs. E. G. Stoltz and W. O. Lum; "Direct-Current Control for Hoisting Equipment in Industrial Plants," by Mr. W. T. Snyder; "Control of Alternating-Current Motors in Iron and Steel Mills," by Mr. Arthur Simon, and "The Alternating-Current Hoist," by Mr. Raymond E. Brown.

Annual Convention

For the annual convention, to be held at Deer Park, Md., June 29 and 30 and July 1 and 2, the following tentative program has been arranged:

Address by President Paul M. Lincoln; "The Electric Strength of Air," by Prof. J. B. Whitehead; "The Reluctance of Some Irregular Magnetic Fields," by Mr. John F. H. Douglas; "The Measurements of Dielectric Losses with the Cathode-Ray Tube," by Mr. John P. Minton; "Irregular Wave Forms; the Significance of Form Factor, Distortion Factor and Other Factors," by Dr. Frederick Bedell; "Classification of Alternating-Current Motors," by Mr. Val A. Fynn; "Alternating-Current Commutator-Motor Classification and Nomenclature," by Mr. Frederick Creedy; "Short-Circuits on Alternators," by Prof. Comfort A. Adams; "Electricity in Grain Elevators," by Mr. H. E. Stafford; "Fields of Motor Application" (topical discussion), by Mr. D. B. Rushmore; "Construction and Maintenance Costs of Overhead-Contact Systems," by Messrs. E. J. Amberg and Ferdinand Zogbaum; "The Contact System of the Butte, Anaconda & Pacific Railway," by Mr. J. B. Cox; "Third-Rail and Trolley System of the West Jersey & Seashore Railroad," by Mr. J. V. B. Duer; "Top-Contact Unprotected-Contact Rail for 600-Volt Traction System," by Mr. Charles H. Jones; "Under-Running Third-Rail Conductors," by Mr. Edwin B. Katté; "Phase Angle of Current Transformers," by Mr. Chester L. Dawes; "Instrument Transformers," by Mr. Charles L. Fortescue; "The Induction Watt-Hour Meter," by Prof. V. L. Hollister; "Economic Operation of Electric Ovens," by Mr. Percy W. Gumaer; "Class Rates for Electric Light and Power Systems," by Prof. Frank G. Baum.

At a joint meeting of the Illuminating Engineering Society and the Institute, to the held Wednesday evening, the following papers will be read: "The Effective Illumination of Streets," by Mr. Preston S. Millar, and "Systems of Street Illumination," by Dr. Charles P. Steinmetz.

Deer Park, which is on the main line of the Baltimore & Ohio Railroad, is the largest summer resort in the Allegheny Mountains, It is situated eleven hours from Cincinnati or New York, nine hours from Philadelphia, seven hours from Pittsburgh, thirteen hours from Columbus, twenty-one hours from Chicago and twelve hours from Cleveland, and has through Pullman car service from all of these cities. Mr. John H. Finney, Washington, D. C., is chairman of the convention committee.

Panama-Pacific Convention

The Panama-Pacific convention committee is actively at work making plans and arrangements for a convention to be held in San Francisco, Sept. 16 to 18, 1915, during the week immediately preceding the International Engineering Congress. The personnel of the convention committee appointed by President Lincoln is as follows: Mr. W. W. Briggs, chairman, and Messrs. A. H. Babcock, A. M. Hunt, A. G. Jones, H. A. Lardner, J. T. Whittlesey and C. J. Wilson, all of San Francisco; Prof. C. L. Cory, University of California; Prof. Harris J. Ryan, Leland Stanford, Junior, University; Mr. L. T. Robinson, chairman Institute meetings and papers committee; Messrs. H. H. Barnes, Jr., and George F. Sever, of New York.

The San Francisco committee has already made reservations for accommodations in the Auditorium Building for holding the technical sessions and other meetings of the convention. The official headquarters of the Institute will be at the Hotel St. Francis.

It has been decided to limit the technical sessions to the mornings and afternoons of Thursday and Friday, Sept. 16 and 17, thus leaving the remainder of the time free for inspection trips or other plans.

Investigation of United Gas Improvement Company

President Bodine of the United Gas Improvement Company of Philadelphia, which is under investigation by the Department of Justice, is still submitting material to the department in connection with the claim of the company that it is not violating any of the anti-trust laws as has been charged.

At the department in Washington it is said that, although this material from Mr. Bodine has been received from time to time, opportunity has not been offered to give it consideration, for the reason that department officials have been busy with the preparation of the brief in the International Harvester Company case. This brief has now been completed.

The department confirms reports recently published that, so far as is now known, the investigation of the United Gas Improvement Company and the settlement of that case will not be turned over to the new Federal Trade Commission.

Plans for Forming Industrial Electric Heating Association

According to announcements which were given wide circulation, an electrical industrial heating association was to have been formed at Dayton, Ohio, on March 16. That the plan attracted lively interest was evidenced by the fact that the announcement brought together a group of men from as far west as Illinois and from as far east as Massachusetts. Absence of leaders of the movement prevented any action being taken. On the following day, however, in one of the sessions of the Ohio new-business men's meeting, there was a short discussion of the question of forming an industrial heating association, in which Mr. H. O. Loebell, of H. L. Doherty & Company, New York, and Mr. A. K. Young, of the Toledo (Ohio) Railways & Light Company, both expressed the belief that such an organization should be formed. Its object should be, said they, to bring together more often the men vitally interested in industrial heating, that they might assist each other in the collection of heating data and in the rapid development of the electric-heating business.

In reviewing the question of electric industrial heating from three angles, Mr. Loebell said that to the central station such heating represented enormous possibilities. It is a twenty-four-hour load having unity power-factor. There are five times as many heating "prospects" as there are motor-service "prospects," and practically every heating customer represents a heavy load. From the standpoint of the customer electric industrial heating is safe, convenient and easily controlled, and frequently it insures a better product than other heating media. Considered from an engineering standpoint, the immediate future of the electric-heating business, said Mr. Loebell, is bright, for the average efficiency of oil, gas and other furnaces and ovens is only about 1 per cent, a figure above which the electrical apparatus will surely operate, giving at the same time the further advantage of permitting the furnace atmosphere to be absolutely controlled and oxidation entirely eliminated.

Mr. A. K. Young, in closing the discussion, requested that all interested in the formation of an electric heating association communicate with him in order that a meeting of prospective association members might be held in Toledo on May 1.

Annual Report of Cities Service Company

In reviewing earnings of the Cities Service Company of New York for the year ended Dec. 31, 1914, Mr. Henry L. Doherty, the president, said that earnings are satisfactory, especially in view of existing conditions, and fully justify the belief that there is exceptional stability in the earning power of public utility properties. He adds:

"The results demonstrate the value of the diversity obtainable by means of the holding company, and they further show that the properties of the company have been so selected with respect to character and location as to insure stability of earnings under all conditions. In spite of the general business disturbances of the last year, which in many places were acute, earnings were maintained.

"The physical condition of the properties of the subsidiary companies has been well maintained, and the relations with the communities served are harmonious. Extension and betterment work must be continued, however, to keep pace with the growth of the communities served, and there are payments to be made during the next two and one-half years upon properties heretofore purchased. The earnings are at present being used for these capital requirements. When financial conditions become settled so definitely as to enable your company to finance these requirements economically and to proper advantage by the sale of securities, the earnings will be available for dividends. For the present your directors believe that the policy of deferring dividends is prudent."

Cleveland Municipal Situation

City Solicitor John N. Stockwell of Cleveland, Ohio, was scheduled to spend the latter part of the present week in Columbus for the purpose of ascertaining the date on which the appraisal of physical property of the Cleveland Electric Illuminating Company will be completed, and when the company's appeal from the 3-cent maximum rate ordinance will be heard by the Public Utilities Commission.

A resolution was adopted by the City Council of Cleveland on March 29, protesting against the proposed legislation reducing the staff of the commission by nine appraisal engineers. The resolution was addressed to Governor Willis, the commission and the General Assembly. It was attacked on the floor of the Council by Councilman Fitzgerald as an attempt to embarrass the State administration in its economy program. He said that Mayor Baker and administration councilmen never had been favorable to the commission, preferring municipal competition, and that the resolution was the height of inconsistency.

Another resolution of the City Council called upon the Cleveland Electric Illuminating Company for an accounting of money collected above a 3-cent rate since the ordinance was passed on May 1, 1914. A third resolution calls for a report on procedure preliminary to the purchase of the company's property by the city.

Solicitor Stockwell and Mayor Baker declared that the reduction in the number of appraisal engineers is to be made for the purpose of delaying appraisal of the properties of Cleveland, Cincinnati and other public utility companies and thus postponing settlement of rate questions.

The Cleveland Electric Illuminating Company has delivered to the commission a number of sheets of inventory and the engineers have checked many, but with several other appraisals on hand the work must be done slowly. With the present commission force some time will be required to complete the tentative valuation, after which the final figures will have to be prepared. Hearings on the 3-cent ordinance cannot take place until the appraisement is completed. Mr. Stockwell will attempt to secure material for making a determined fight against the proposed reduction in the commission force.

In anticipation of failure to have the appraisal engineers retained by the commission, Councilman David Moylan is having an ordinance prepared to purchase the property. Mr. F. W. Ballard, commissioner of light and heat, said that the value of the property is between $12,000,000 and $17,000,000.

The board of directors of the Cleveland Chamber of Commerce has made a report opposing the Briggs bill, which is intended to exempt municipal electric-light bonds from the limitations of the Longworth act. The report states that the excess in bonds above the Longworth limitation must be considered as a lien against the utility property alone. The committee also objects to the plan of the city to take over the property of the Cleveland Electric Illuminating Company on the ground that the large sum paid as municipal taxes by the company would be lost to the city if the property were owned by the municipality.

A bill affecting central stations, introduced by Senator William Behne in the Ohio Legislature, has been reported favorably by the Senate committee on public

utilities. It provides that so far as bonds issued for the construction or acquirement of a public service plant exceed the limits fixed by the Longworth law they shall be a lien upon the property only. The bill provides further that a certain amount must be set aside from income for interest and amortization of bonds.

Valuation in Cincinnati

According to the *Stockholders' Herald*, which is published by stockholders of the Cincinnati Gas & Electric Company in the interest of that company, the valuation of the electrical properties of the company now in progress will cost the lessee, the Union Gas & Electric Company, between $50,000 and $75,000. The appraisers have gone over the different elements of property but have not yet completed their work.

The valuation, which was ordered by the Public Utilities Commission, will be filed with the commission about May 1. The work has been in progress about ten months and is in charge of Messrs. Norton & Bird, Chicago. It was expected that the detailed schedules of the property would be in the hands of President Freeman of the lessee company, the Union Gas & Electric Company, about April 1. Mr. Freeman wanted about one month to consider the financial and legal questions the schedules develop, after which they will be filed with the commission together with a statement of the company.

At a hearing before the commission on March 25, City Solicitor Schoenle of Cincinnati asked why the commission's valuation of the property of the Union Gas & Electric Company had not been completed. Messrs. Linwood G. White, chief appraisal engineer of the commission, and Charles M. McKay, chief electrical engineer of the Union company, were examined. Mr. Schoenle learned that the valuation work on the Union Gas & Electric Company and the Cincinnati Traction Company had already cost the commission $31,731, while but $50,000 had been appropriated for the valuation of these two properties, two in Cleveland and one in Akron. To March 15 the number of days of labor spent by the engineers was 3315 on the Union Gas & Electric Company work, at a cost of $21,089. On the Cincinnati Traction Company valuation engineers have spent 1465 days at a cost of $10,642. The engineers expect to announce a tentative valuation of the light property on June 1.

Federal Trade Commission Affairs

So many organization details have to be decided in connection with the Federal Trade Commission, and, according to the members, so many are likely for some time, that there seems to be little immediate prospect that they will get to work for a while on larger duties.

A complication has arisen in connection with financing the commission. Appropriations were made for salaries of commissioners and for several other items, but there is a difference of opinion as to whether the larger appropriations for expenses are available immediately. The commissioners intend to ask the Comptroller of the Treasury to rule upon just what appropriations are available. Some of the appropriations were made available on July 1, and the commission in any event will have money for expenses at that time. In the meanwhile the appropriations for the old Bureau of Corporations, which were made available for the commission, are being used, but they cannot go very far. The recent appointment of former Representative Stevens as special counsel was an appointment by the Bureau of Corporations before that body went out of existence.

Boston Edison New-Business Campaign

A comprehensive new-business campaign has just been formulated by the Edison Electric Illuminating Company of Boston, Mass., the plans including an electrical census of every building within the 700 square miles of territory covered by the company's lines. The canvass is to be be made by the sales department, the territory having been laid out in sixteen districts with a captain in charge of each. Boston proper will be left until the last in view of the value of the experience gained in the suburban districts, and when the latter are thoroughly canvassed the entire force will be concentrated upon the metropolitan center. Fifteen special canvassers have been added to the sales department from departments of the company where there is at present an insufficient amount of work for the retention of these men. The hours for the canvass will be from 10 a.m. to 9 p.m. on weekdays.

Each district captain will be provided with a map of the district assigned to him, showing streets by names and where the company's lines are situated. The captains will assign to each man under their charge daily routes, and a graphic record will be kept on the maps showing progress. This record will at all times be open to the inspection of any employee.

The canvass will progress in the order of, first, all stores in the various commercial centers in each district; second, all buildings on the commercial lines; third, buildings on street lighting lines only; fourth, all buildings in the district outside the lines of the company. Factories will be canvassed simultaneously by the special agents.

Complete records will be kept daily by each canvasser, by the district captain and by the sales department. There will be a daily discussion of the reports at the morning conference of department superintendents with the general superintendent. An extensive card-record system will be used, which will later facilitate the tabulating of data in the Hollerith machine to determine such points as the number of customers on the lines, the number of "prospects" who are non-users, what appliances are in use at the date of the canvass, methods of illumination and power employed, and territory where energies should be concentrated. The company's motto, "Electricity for everybody," is meeting with an enthusiastic reception, and it is believed that the canvass now inaugurated will prove of great benefit to the company and to the residents of the municipalities reached by its lines.

Stability of Public Utility Earnings

In the "Public Utilities Number" issued by the *Evening Post* of New York on March 31 facts are cited to show that of all industries the public utility industry was hit least hard by unfavorable developments in 1914. As a typical instance the Public Service Corporation of New Jersey, gross earnings of which increased 4 per cent over 1913, is cited. Returns from thirty-five Middle Western public utilities are also given. These companies showed in August, 1914, 4.5 per cent increase in gross earnings, in September 2.4 per cent increase, in October 1.7 per cent increase, in November 0.8 per cent decrease, in January 6.6 per cent increase, in February 6.3 per cent increase. The returns of seven electric utilities stated separately showed that July, 1914, gross earnings increased 10 per cent. There was a steady decrease in the rate of gain until September, when the increase was slightly less than 6 per cent above September, 1913. October showed 7.6 per cent increase and November 2.5 per cent increase. Since then there has been an improvement.

Miscellaneous News Notes

University of Illinois Electric Show.—An electrical show will be held by students of the electrical engineering school of the University of Illinois at Urbana, Ill., April 8 to 10. A number of manufacturers of electrical equipment will make exhibits. Mr. Ralph Herman is manager of the show.

Municipal Electric-Light Bonds Not to Be Used for Gas Lamps.—Bonds sold for the purpose of establishing a municipal electric-light plant cannot be used in the purchase and installation of gas lamps for lighting streets, according to the opinion given by Mr. Max Schoetz, assistant city attorney of Milwaukee, Wis.

Agreement on Street-Lighting Rates in Youngstown, Ohio.—Messrs. H. Whitford Jones and A. B. Stitzer and F. C. Caldwell, of the Youngstown & Sharon Street Railway, acting as arbitrators on the revision of street-lighting rates in Youngstown, Ohio, have reached an agreement which will be made known soon. The rate agreed upon will be effective from Dec. 17, 1914, until the improved system is installed and the new rates, established some time ago through competitive bids, become operative.

Minneapolis Minstrel Show for Contractors and Central-Station Men.—About fifty employees of the Minneapolis (Minn.) General Electric Company with musical talent and histrionic ability entertained the electrical contractors of the city and the remainder of the central-station employees with a minstrel show on March 18. The show, which was attended by about 1500 persons, supplanted for this year the banquet which the central-station company has annually given for the Minneapolis electrical contractors.

Court Order Disregarded in Cincinnati.—City Solicitor Walter Schoenle of Cincinnati, Ohio, has notified Attorneys Joseph W. O'Hara and Michael Muller, representing the Diamond Light Company, that their client is in contempt of court through disregard of the injunction of the Court of Appeals, which was confirmed by the Supreme Court. The company was prohibited from placing its wires under the streets without authority from the City Council. The city solicitor advises that the lawyers notify their client of this fact and render proceedings unnecessary.

Accident in Indianapolis—An accident the cause of which has not yet been definitely determined occurred in Indianapolis on March 29, when the entire "underground district" of the Merchants' Heat & Light Company was out of operation, because of a mysterious burning out of cables beneath a manhole near the power plant at Blackford and West Market Streets. After the accident the load was carried for forty-five minutes on the batteries in substation No. 1. Then these proved to be unequal to the strain, and part of the city was thrown into darkness.

Kansas City Electric Light Company's Exhibition.—The third semi-annual electric show of the Kansas City Electric Light Company opened March 25, for ten days, with the first-floor front of the Electric Shop decorated in Oriental fashion. Exhibitors had well-defined sections for the display of electrical devices. Electrically prepared refreshments were served, and there were demonstrations of various devices. During the show electric utensils were sold by all at 20 per cent discount and on easy terms. The festival was under the direction of Miss Marie J. Russell, manager of the Electric Shop, and her assistants.

Civil Service Examination for Mine Electrician.—An examination for mine electrician will be held by the United States Civil Service Commission on April 28 to fill a vacancy in the Bureau of Mines, Department of the Interior, for service in the field, at a salary ranging from $1,200 to $1,500 a year. The duties of this position will be to make investigations bearing upon the safety of electricity in mines and the causes of mine disasters for which electricity may have been responsible. The duties will involve considerable field work and travel. At least one year's study of electrical application in a technical school of recognized standing and five years in actual underground electrical work in mines are prerequisites for consideration for this position. Persons desiring to take the examination should apply for Form 1312, stating the title of the examination for which the form is desired, to the United States Civil Service Commission, Washington, D. C.

Associations and Societies

I. E. S. Convention.—The ninth annual convention of the Illuminating Engineering Society will be held at the New Willard Hotel, Washington, D. C., Sept. 20 to 23 inclusive. Mr. E. S. Marlow, of the Potomac Electric Power Company, Washington, D. C., is chairman of the convention committee.

Institute of Radio Engineers.—At a meeting of the Institute of Radio Engineers to be held at Columbia University April 7, at 8.15 p. m., Dr. Irving Langmuir will present a paper on "Applications of Thermionic Currents to Radiotelegraphy and Radiotelephony." Dr. Langmuir will outline the theory of thermionic currents in tubes of very high vacuum, describing several pieces of apparatus which have been built for receiving radio signals, and also some devices for producing electrical oscillations and controlling them for radiotelephony.

New York Electrical Society.—Mr. T. C. Martin, secretary of the National Electric Light Association, delivered an address on "Electrical Aspects and Lessons of the San Francisco Exposition," at the 336th meeting of the New York Electrical Society on March 25. His address was illustrated by means of numerous lantern slides depicting some of the remarkable illumination at the Exposition. Mr. Willard E. Case was elected to honorary membership in the society. The next meeting will be held on Wednesday, April 14, at which time Mr. Thomas A. Watson will deliver an address on "The Birth and Babyhood of the Telephone."

Meeting of N. E. L. A. Accident Prevention Committee.—A meeting of the accident-prevention committee of the National Electric Light Association was held at the headquarters in New York on March 26. The following were present: Messrs. Martin J. Insull, chairman; J. L. Murrie, T. A. Kenney, M. W. Alexander, F. C. Sargent, and C. B. Scott, secretary. Messrs. W. J. Canada and Frank W. Glading, of the Bureau of Standards, also attended the meeting. The committee continued its work on the safety rules and made progress. Another meeting will be held at Buffalo on April 23 for the purpose of finishing the San Francisco convention report.

Joint Meeting on Illumination.—At a joint meeting of the National Electric Light Association, the National Commercial Gas Association and the Illuminating Engineering Society in New York on Wednesday, April 7, Mr. R. F. Pierce, of the N. C. G. A., will read a paper entitled "Illuminating Engineering as Applied to the Business of the Gas Company"; Mr. Norman Macbeth, of the I. E. S., will read a paper entitled "Value of the Illuminating Engineering Society to Commercial Men," and a representative of the N. E. L. A. will present a paper on a similar topic. The meeting, which will be held in the auditorium of the Consolidated Gas Company's building, 130 East Fifteenth Street, will be preceded by an informal dinner at Keen's Chop House at 6.15 p. m.

Meeting of New England Section, I. E. S.—A special mid-season meeting of the New England Section of the Illuminating Engineering Society was held at the Engineers' Club, Boston, Mass., on March 26. Sessions occupied both afternoon and evening, Dr. Louis Bell presiding at the former, and Vice-president C. A. B. Halvorson, Jr., at the latter. The program consisted of the following papers: "Daylight Gas," by Dr. H. P. Gage, Corning, N. Y.; "Artificial Daylight," by Mr. R. B. Hussey, Lynn, Mass.; "Semi-indirect Lighting by Gas," by Mr. R. F. Pierce, Philadelphia; "Determining Factors in Artificial Illumination Problems as Related to Architecture and Decoration," by Mr. David Crownfield, Boston, Mass., and "Safeguarding the Eyesight of School Children," by Mr. M. Luckiesh, Cleveland, Ohio.

Jovians and Electrical League of Cleveland.—At a rejuvenation in the assembly room of the Hollenden Hotel, Cleveland, Ohio, on March 25, the Jovian Chapter of the Electrical League of Cleveland initiated twenty candidates. Messrs. George S. Miller, president of the league, and M. M. Moffet were the principal speakers at the dinner. Messrs. H. C. Turnock and R. E. Campbell, first and second tribunes of the Jovian Chapter, were in charge. Nearly 200 members of the league were guests of the Cleveland Telephone

Company at a luncheon in the telephone building at noon on the same day. Mr. Norman Anderson, traffic superintendent, made an address, illustrated with stereopticon views, on the operation of a modern telephone system. The guests were then taken on an inspection trip through the exchange.

Worcester Branch, A. I. E. E.—The fourth regular meeting of the Worcester Polytechnic Institute Branch of the American Institute of Electrical Engineers was held in the lecture hall of the Electrical Engineering Building March 24. The meeting was addressed by Mr. A. L. Rohrer and Mr. J. J. Linebaugh, both of the General Electric Company, who spoke on the "Electrification of the Butte, Anaconda & Pacific Railroad."

Color and Illumination.—Mr. M. Luckiesh, of the research laboratory of the National Lamp Works of the General Electric Company, Cleveland, Ohio, gave a résumé of the general subject of color in his address before the Chicago Section of the Illuminating Engineering Society, March 25. Lumière color photographs of light spectra and color effects were used to illustrate the talk. Mr. Luckiesh pointed out the fact that the light from even the gas-filled tungsten lamp is much yellower than average daylight. A "daylight" tint can be produced by subtraction of the excess red rays, with a resultant specific consumption of 1.2 watts per cp. In closing, the speaker referred to "color music" and the recent Carnegie Hall recital in New York City. To demonstrate the general esthetic attractiveness of certain colors, Mr. Luckiesh cited recent experiments in which twenty-six subjects were asked to indicate their successive preferences for fifteen standard color cards. All the subjects showed close agreement in preferring colors at the opposite ends of the spectrum—reds and blues—while twenty of the twenty-six placed lemon-yellow last. Mr. W. A. Durgin, Dr. C. N. Black, Mr. Albert Scheible, Prof. C. Freeman and Mr. C. A. Luther took part in the discussion.

Railway Signal Association at Chicago.—The quarterly meeting of the Railway Signal Association held at the Auditorium, Chicago, March 15, was given over to the recital and discussion of committee reports on automatic block signaling, lightning protection, storage-battery charging, mechanical interlocking, contracts and standards. Two sets of specifications for lead storage cells were submitted by the storage-battery committee, of which Mr. R. B. Elsworth, New York Central, was chairman. The substance of the present manual is closely followed, but options are given to the purchaser as to detail features. Rigorous definitions of the requisites for choke coils and lightning arresters for signaling circuits were presented by Chairman E. G. Hawkins of the committee on lightning protection. During the discussion on signaling Mr. G. H. Dryden, of the Baltimore & Ohio Railroad, made the interesting statement that traffic on a single-track road might now be handled with entire safety by the indications of signals alone and without the aid of telegraphed or telephoned train orders. Mr. T. S. Stevens, signal engineer of the Santa Fé, is president of the Railway Signal Association, and Mr. C. C. Rosenberg, Times Building, Bethlehem, Pa., is secretary-treasurer.

Co-operative Electrical Meeting at Boston.—About 150 electrical representatives attended a meeting at Paul Revere Hall, Boston, Mass., on March 26, to discuss co-operative electrical development. Mr. Frank S. Price, president of the Pettingell-Andrews Company, Boston, occupied the chair, and the speakers were President L. D. Gibbs of the New England Section, National Electric Light Association; Mr. J. M. Wakeman, general manager of the Society for Electrical Development, Inc., New York; Mr. Harry W. Alexander, in charge of the publicity bureau, and Mr. A. J. Edgell, in charge of the display service bureau of the society. The purposes and accomplishments of the society were fully explained, and a large number of lantern slides of its equipment, publicity matter, window-display methods, etc., were shown. It was stated that in this country 225 reels, emphasizing the value and convenience of electric service are now running as incidental features in forty-five dramas. These will occupy the screen for one year at a cost of about $7,000. Central stations are beginning to feel the impetus of this work in the direction of increased day loads. It was announced that electrical men in Great Britain have signified their willingness to make "Electrical Prosperity Week" international, and that, as the last week of the Panama-Pacific Exposition coincides with this period, the management of the latter has agreed to feature electrical energy in closing that exhibition.

Public Service Commission News

Illinois Commission

Commissioner Thompson heard testimony on March 30 at Chicago on the complaint of Mr. James B. Hogarth against the Chicago Elevated Railways Collateral Trust. Mr. Gilbert Porter represented the trustees and Mr. Seymour Stedman the complainant. On examination, Mr. Porter described the purchase of a controlling interest in the elevated-railway companies by the trustees through the note issue. He declared that the trust has issued participation shares, but is not a company operating utilities, and is therefore not under the jurisdiction of the commission. Mr. Stedman questioned whether the actual control of the elevated roads by the trust does not make it a utility under the provision of the law relating to "indirect" control. Mr. Porter conceded that at different times the trust has loaned the elevated roads funds. The complaint that the elevated railroads had issued notes running beyond twelve months and applied the proceeds to the payment of dividends was set for hearing on March 31. On April 10 the Hogarth complaints aaginst the Commonwealth Edison Company will be heard.

Indiana Commission

The South Bend Home Telephone Company, through its president, Mr. Elmer E. Daicey, has filed a petition with the commission asking that the Rochester Telephone Company, of Rochester, Ind., be ordered to restore a toll line between Argos and Logansport. The Rochester company is alleged to have cut the line on March 25, following arguments between the two companies over the ownership of the line.

One of the principal decisions of the commission has been assailed in the federal court of the Indiana district, Judge A. B. Anderson presiding, by the Evansville Public Service Company. Commissioner John F. McClure wrote the opinion in the case, which fixed gas rates at 85 cents per 1000 cu. ft. The utility declared that the rate was confiscatory, while citizens held that it was too high. The company contends that the commission valuation of $750,000 for rate-making purposes was confiscatory and that the total should have been $1,400,000.

The bill asks a temporary restraining order enjoining the commission from attempting to enforce its order. It attacks the validity of the public utility act and alleges that the order of the commission, as construed by the Superior Court of Vanderburg County, denies protection of the laws and deprives the company of its property without due process of law, in violation of the Fourteenth Amendment to the United States Constitution.

The complaint also alleges that the act is void in that it provides for unreasonable penalties for violations of its terms. Conditions at Evansville because of the situation are growing more complicated. Mayor Benjamin Bosse has told consumers not to pay their February bills, which were sent out late, because they were not made out at the commission's rates. The company contends that its former rates should still be in force.

The company has also filed a suit for injunction against the commission in the Vanderburg Superior Court, setting out the facts stated in the federal court. It asked for a temporary injunction against the commission prohibiting it from enforcing its order. The commission objected on the ground that while the public utility act provides for injunctions on final hearings, it does not provide for temporary injunctions. This was upheld by the Vanderburg Superior Court, and the company failed to obtain the injunction.

Attorney-General Richard M. Milburn of Indiana is preparing to assist Mr. Burt New, counsel to the commission, and possibly other attorneys, in defending the utility act and the order.

New Jersey Commission

The Supreme Court has handed down an important decision setting aside the recent order of the Board of Public Utility Commissioners directing the Public Service Electric Company to furnish free service in the municipal buildings at Plainfield. The electric company, as successor to the Plainfield Gas & Electric Company, notified the city that it could not continue lawfully to furnish free service heretofore enjoyed. The city, in appealing to the Board of Public Utility Commissioners, held that Section 18 of the public utility law was not applicable to the case, as it prohibits only unreasonable preference or advantage in giving, and was upheld by the board in its contention. In the case before the court the commission set forth that the failure of the courts to sustain such a contract would have a far-reaching effect in relieving public utility corporations from obligations assumed under their charter.

In its decision the court says: "The contention at issue clearly ignores the spirit of this legislation. One of its objects was to abrogate the granting of gratuities to municipalities and thereby prevent reciprocal favors from being granted to the donors. The evil sought to be eradicated was the insidious influence which might be exercised on municipal bodies and officers, against the general public welfare, by the donors of such gratuities. The Board of Public Utility Commissioners by the statutes creating the commission has the power to enforce certain legal obligations upon the company, but the language is not broad enough to confer on the board the power to enforce specific performing contracts. The order made directs the specific performance of a contract between the parties."

New York Commissions

Col. William Hayward, counsel for the legislative investigating committee, has been nominated by Governor Whitman to succeed Mr. Milo R. Maltbie as a member of the First District commission. The term of Mr. Maltbie expired on Feb. 1, but, under the law, he remained in office until the appointment of his successor was confirmed by the Legislature. The appointment of Colonel Hayward was confirmed by the Senate on March 31. In a public statement he said: "I shall devote myself absolutely and exclusively to the prompt, fair and vigorous enforcement of the public service law as it was originally intended and try to secure for the people of New York City decent and adequate service by public service corporations. As far as I am concerned, there will be no politics directly or indirectly in the Public Service Commission. The recent investigation established certain standards in the public mind for which I, perhaps, am largely responsible. I shall be glad to be judged hereafter by those standards."

Commissioner Martin S. Decker, of the Second District commission, has filed a statement with the legislative investigating committee in which he says: "In the present investigation no effort has been made to bring out with clearness and with any specification the great amount of work which has been done by the commission and its various members, the character of that work or the results of it as affecting the public interest, and it is therefore impossible for this committee to make any finding whatsoever upon the general efficiency and attention to duty of the commission or its members unless it shall find in favor of the commission as to its general efficiency and attention to duty. In the testimony taken before the committee seven cases out of 4000 have been selected as the subject of examination with reference to my work. Three of those cases are mentioned solely on the ground of delay."

In accordance with the report of the legislative committee, a bill has been introduced increasing the regulative measures over telephone companies. It transfers jurisdiction in New York City and Long Island to the First District commission. All telephone companies are made subject to regulation, adding 1000 systems now exempt. The companies are classified as commercial and mutual. Authority is given to the commissions to establish standards of service. Power is given to the commissions to compel commercial companies to connect. Every company is required to obtain a certificate of public convenience and necessity before building or extending. The bill provides further that commissions shall have the same control over stocks, bonds, transfers and sales of property of telephone companies as over railroads. Companies like the American Telephone & Telegraph Company are subjected to complete control.

In the decision of the Second District commission refusing the request of the city of Rochester for reduced fares on the New York State Railways, the claim of the complainant that an extravagant price was paid to the Rochester Railway & Light Company for electric energy was considered. Comparisons with certain prices paid by the Syracuse and Buffalo street railroad companies were submitted. It was agreed that this comparison should be investigated by the commission's engineer and his report served upon the parties, and that further hearing should be had as to the energy rate if desired. The engineer's report finds that the energy rate paid by respondent is not unfavorable as compared with the prices paid by the Syracuse and Buffalo roads, and both parties submitted the case with that report in evidence and without desiring further hearing.

There were no appearances against the order of the Second District commission authorizing the capitalization of the Canadian-American Power Corporation at the rehearing on March 24, which was ordered by the commission after it had been notified through the State Department at Washington that the Canadian government was calling attention to the yearly terms of its license for the export of electricity.

Mr. Charles K. Beekman, attorney for the company, was the only person to appear. He told the commission that it would be inconceivable that the Canadian government would exercise its right to revoke this license. He said that it would precipitate a question of international complication. If any such adverse action should be contemplated by the Canadian government, he said, the government would first have to withdraw prior permissions for the export of energy by companies which are now supplying the International Railway, many important industries in Buffalo and public and private enterprises in the western end of the State.

Mr. Beekman said that he had been informed that a distinguished firm of Toronto attorneys was now engaged in preparing to test the powers of the Canadian government under the Canadian constitution to take such an action. It was the contention of these lawyers that such action, despite the terms of the license, would be in violation of the provisions of the Canadian constitutional safeguard of contractual rights in the same manner as they are safeguarded in the basic United States law.

It was brought out in the course of discussion between Mr. Beekman and the commission that before any further steps can be taken by the Canadian-American Power Corporation to organize and exercise its rights the company must come before the commission for an order. No formal order has ever been issued in this case, and such action as the company has taken up to now has been merely in pursuance of an opinion rendered by the commission. Mr. Beekman contended that there was nothing now before the commission different in any way from what was before it at the time the opinion was rendered. If anything new should develop between now and the time the company applies for a formal order, it could be considered.

It further developed that the Canadian-American Power Corporation has not yet progressed even so far in its organization as to commence to pay rentals on its rights. Mr. Beekman said that none of the rights had been waived as, in view of the financial strain, persons to whom the rentals were due had never pressed for payment.

Ohio Commission

Should the Reighard bill, recommended for passage by the public utilities committee of the Ohio House of Representatives, become a law, the decisions upon the matter of making physical valuations will be left to the discretion of the Public Utilities Commission. Under the bill, even when a City Council demands a valuation for rate-making purposes, the commission may first make an investigation to decide whether it is necessary.

Pennsylvania Commission

Acting under instructions of the commission, Attorney-General Francis Shunk Brown of Pennsylvania has rendered an opinion to the effect that the York Railways Company may acquire, hold and own the stock and bonds of a light and power company.

Personal

Mr. T. McLean Jasper, a sanitary engineer of Chicago and a former turbine engineer in the Fisk Street station of the Commonwealth Edison Company, sailed for England March 26 to join the British army.

Mr. Hubert Schuurman Wynkoop, who was last week elected president of the National Association of Electrical Inspectors, has been identified with the electrical inspection service of the city of New York for the past twenty-one years and is now electrical engineer in charge of the division of electrical inspection. After securing the degree of mechanical engineer at Stevens Institute of Technology, he gained practical experience with the Leonard & Izard Company, the Edison General Electric Company and the General Electric Company in various localities throughout the West and South. Mr. Wynkoop is a fellow of the American Institute of Electrical Engineers, a member of the Brooklyn Engineers' Club, a member of the Municipal Engineers of New York, the secretary of the department of electricity of the Brooklyn Institute, and an associate member of the National Fire Protection Association, serving on the electrical committee. Through these various activities, and more particularly through his identification with the preparation of the National Electrical Code and its enforcement, Mr. Wynkoop is widely and favorably known.

H. S. WYNKOOP

Prof. Harris Joseph Ryan, who has just been appointed honorary vice-president of the American Institute of Electrical Engineers to act as special honorary representative and officer of the Institute on the Pacific Coast during the Panama-Pacific Exposition, is well known in electrical-engineering circles. Before going to the Pacific Coast he was professor of electrical engineering at Cornell University. He is now professor of electrical engineering at the Leland Stanford, Jr., University. Professor Ryan was born at Powell's Valley, Pa., Jan. 8, 1866, and was educated at Baltimore City College, Lebanon Valley College and Sibley College, Cornell University, where he took the course in electrical engineering. Among his more practical contributions to electrical engineering have been a type of single-phase commutator motor which is very largely used throughout the United States and, in conjunction with Mr. M. E. Thompson, a method of armature compensation which has been applied to direct-current machinery and also to alternating-current motors and generators. Professor Ryan has contributed a number of papers to the American Institute of Electrical Engineers and to the technical press. He was a judge of the board of awards, department of electricity, World's Columbian Exposition, a vice-president of the American Institute of Electrical Engineers and a delegate to the International Electrical Congress held at St. Louis in 1904, and has been consulting engineer of the Bureau of Los Angeles Aqueduct Power since 1909.

HARRIS J. RYAN

Mr. T. D. Crocker, who was elected president of the Minnesota Electrical Association last week, was graduated from the school of electrical engineering of the Ohio State University, at Columbus, Ohio, with the class of 1904. Before attending the university he had gained considerable experience in handling electrical equipment in the plant of the Lincoln Electric Company at Cleveland, and upon completing his college course he accepted a position with the Milwaukee (Wis.) Electric Railway & Light Company. During eight years' service with the latter company Mr. Crocker rose through several positions in the operating departments to be general superintendent of the central heating department and later became the company's commercial engineer. In the fall of 1912 he joined the organization of H. M. Byllesby & Company as commercial engineer for the Consumers' Power Company at St. Paul, Minn., and later was transferred to Minneapolis and was made assistant general manager of the Minneapolis General Electric Company, which position he now holds.

Corporate and Financial

United Electric Light Capital Increase.—Stockholders of the United Electric Light Company of Springfield, Mass., have voted to issue $250,000 stock at 185. The proceeds will be used to retire floating debt.

Cambridge Electric Special Dividends.—The Cambridge (Mass.) Electric Company has declared a special dividend of $6 out of its earnings from the sale of electrical appliances, payable on April 2.

Louisville Gas & Electric Dividends Deferred.—The Louisville (Ky.) Gas & Electric Company failed to declare the dividend of 1½ per cent payable on March 1 on the preferred stock, consideration having been deferred until May.

Southern California Edison to Acquire More Property.—The California Railroad Commission has authorized the Pacific Electric Railway Company to sell its heating and electric system at Playa del Rey, Cal., to the Southern California Edison Company for $1,544.

Kansas City Railway & Light Time Extension.—Notice has been given that the committee under the agreement dated April 3, 1913, for the deposit of first lien refunding 5 per cent gold bonds of the Kansas City (Mo.) Railway & Light Company, has extended the period in which depositors will be entitled either to receive new securities or cash, pursuant to the sale or plan for reorganization or readjustment, or to the return of deposited bonds or the proceeds thereof for one year from April 3, 1915. The committee is composed of Messrs. John B. Dennis, Acosta Nichols, I. J. Hanauer and James J. Storrow.

Atlantic Gas Foreclosure Sale.—The bondholders' protective committee of the Atlantic Gas & Electric Company bought in the collateral behind the series "A" and series "B" bonds at the recent foreclosure sale at 10 cents on the dollar. A notice will be sent within the next few days to bondholders who have not deposited their bonds, giving them two weeks in which to do so. A large majority of the bonds have been deposited, and it is thought that the remainder will be sent in, especially since by staying out they will receive only their share of the collateral back of the bonds at 10 per cent of face value, and also since the assessment per bond will be in the neighborhood of $25. The General Gas & Electric Company of New York is managing the properties, and as soon as all the bonds are received and stock of the Atlantic company is interchanged for General Gas & Electric stock the Atlantic company will go out of existence.

Columbus Utilities Consolidation Notes.—The consolidation and reorganization of the railway and light properties at Columbus, Ohio, will be complete when transfer of the preferred stock of the Columbus Light, Heat & Power Company for series A preferred stock of the Columbus Railway, Power & Light Company is finished at the State Savings Bank & Trust Company. A deed for the property, franchises and privileges af the Columbus Light, Heat & Power Company in favor of the railway company was filed for record recently in Franklin County. Holders of heat and power stock received a three months' dividend on Jan. 1, and as the next dividend of the railway company is payable on April 1, no adjustment in the dates of payment will be necessary. Holders of common stock of the heat and power company who exchanged their securities for series B stock of the reorganized company will receive one month's dividend on April 1 and a full three months' dividend on May 1.

Kansas Gas & Electric Statement.—The annual report of the Kansas Gas & Electric Company, Wichita, Kan., for the year ended Dec. 31, 1914, shows that the number of electric customers increased from 11,421 in 1913 to 12,583 in 1914. The output in 1914 was 23,408,092 kw-hr. as compared with 18,470,213 in 1913. Of the gross earnings in 1914 $634,701 was derived from sales of electric energy, and $579,413 in 1913. The earnings statement follows:

	1914	1913
Gross earnings	$1,163,349	$1,030,550
Operating expenses and taxes	730,834	658,118
Net earnings	$432,515	$372,432
Interest charges	182,425	175,005
Net income after charges	$250,090	$197,427
Preferred dividend	105,000	105,000
Balance	$145,090	$92,427

United Electric Light & Power Report.—The report of the United Electric Light & Power Company of New York for the year ended Dec. 31, 1914, as reported to the Public Service Commission of the First District of New York, shows:

Operating revenue	$3,821,012
Operating expenses	1,494,191
Uncollectible bills	28,785
Taxes	170,086
Net operating income	$2,127,950
Non-operating income	11,134
Gross income applicable to corporate and to leased properties	$2,139,084
Income deductions, interest	1,092,064
Net corporate income	$1,047,020
Contingent expenses	394,522
Surplus adjustment	53,123
Deficit at beginning of year	38,442
Surplus as reported at close of year	$560,933

Cities Service Annual Report.—The annual report of the Cities Service Company of New York for the year ended Dec. 31, 1914, shows that subsidiaries sold 204,579,392 kw-hr. during the year and at the end of the year had 125,597 kw rating of generating equipment, with a connected load of 234,475 kw, and served 104,900 customers in a population of 942,000. The statement for 1913 and 1914 follows:

	1914	1913
Gross earnings	$3,934,453	$2,172,411
Expenses	116,908	85,348
Net earnings	$3,817,545	$2,087,063
Net interest	420,000	123,062
Net to stock	$3,397,545	$1,964,001
Preferred dividends paid and accrued	1,635,993	908,778
Net to common stock	$1,761,552	$1,055,223
Common-stock dividends	471,048	466,426
Net to surplus	$1,290,504	$588,797

Standard Gas & Electric Report.—The annual report of the Standard Gas & Electric Company of Chicago, Ill., for the year ended Dec. 31, 1914, shows a gain of approximately 60,000 electric customers in 1914, the total at the end of the year being 169,412. On the subsidiary company's lines there were at the close of 1914 21,423 motors, with an aggregate rating of 183,681 hp and 3,108,410 16-cp equivalents. The total output for the year was 380,212,118 kw-hr. The earnings of the subsidiary companies for 1914 were as follows:

Gross earnings	$14,354,689
Expenses	7,613,455
Net expenses	$6,741,234
Interest charges	3,863,161
Amortization of bond discount	21,465
Preferred dividends	1,622,403
Common dividends	605,371
Balance	$628,834
Applicable to Standard Gas & Electric Company	564,039

Southern Sierras Power to Issue Bonds.—The Railroad Commission of California has issued a final order authorizing the Southern Sierras Power Company to issue $300,000 of first mortgage 6 per cent twenty-five-year bonds. The issue was provisionally authorized some weeks ago, but the commission withheld its final approval until the company had adjusted accounts with the Sierras Construction Company, it having developed that the properties of the Southern Sierras Power Company were built by the Sierras Construction Company, under contracts by the terms of which the construction company charged the power company with the cost of the work and added thereafter 15 per cent as a profit to the construction company. The power company has now arranged to eliminate the profit which it was proposed should accrue to the construction company and the commission has given its final approval to the bond issue. The Sierras Construction Company and the Southern Sierras Company are controlled by the same interests.

Astoria Light, Heat & Power Report.—The report of the Astoria Light, Heat & Power Company of New York for the year ended Dec. 31, 1914, as reported to the Public Service Commission of the First District of New York, shows:

Operating revenue	$6,020,045
Operating expenses	4,065,076
Taxes	193,917
Operating income	$1,761,052
Non-operating income	4,318
Gross income applicable to corporate and leased properties	$1,765,370
Interest and rent	357,358
Net corporate income	$1,408,412
Surplus at beginning of year	1,824,552
Total	$3,232,564
Dividends	450,000
Contingent expenses	536,909
Surplus adjustment	47,297
Surplus at close of year	$3,188,358

Southern California Edison Annual Report.—The records of the Southern California Edison Company, of Los Angeles, Cal., according to the company's annual report for the year ended Dec. 31, 1914, show the number of incandescent lamps in 50-watt equivalents on Dec. 31, 1914, as 1,799,762, compared with 1,634,185 on Dec. 31, 1913. At the end of 1914 the company had 108,439 electric meters, compared with 96,851 in the previous year, and 8606 motors, with a total of 136,384 hp, were on the line at the end of 1914, as compared with 7485 motors, with 118,610 hp, in 1913. The number of arc lamps was 2056 in 1914 and 2162 in 1913. The company has 42,500 hp installed in water-power plants and 77,300 in steam plants, a total of 119,800 hp. Earnings were as follows:

	1914	1913
Gross earnings	$4,855,141	$4,779,280
Operating expenses, including taxes, insurance and maintenance, but exclusive of depreciation	2,332,164	2,430,291
Net earnings	$2,522,977	$2,348,989
Interest and amortization	892,010	813,969
Surplus to dividends and depreciation	$1,630,967	$1,535,020

New York Edison Report.—The statement of the New York Edison Company for the year ended Dec. 31, 1914, as filed with the Public Service Commission of the First District of New York, showed:

Operating revenue	$23,538,342
Operating expenses	9,932,976
Taxes	1,361,624
Uncollectible bills	101,767
Total deduction	11,396,367
Operating income	$12,141,575
Non-operating income	1,370,105
Gross income applicable to corporate and leased properties	$13,512,080
Interest, rents, etc	3,788,144
Net corporate income	$9,723,936
Other credits from surplus	1,115
Previous surplus	29,614,703
Total	$39,339,754
Deductions:	
Renewal and contingency reserve	3,483,055
Dividends	3,720,204
Miscellaneous debits	45,151
Surplus at close of year	$32,091,344

New England Company Merger.—The amended plan of consolidation or merger of the New England Power Company of Maine, the Connecticut River Power Company of Maine and the New England Company was adopted at a recent meeting. According to this amended plan, the holders of the outstanding $500,000 of 6 per cent preferred stock of the Connecticut River Power Company of Maine shall receive in place thereof the entire authorized and outstanding $500,000 of 6 per cent preferred stock of the Connecticut River Power Company of New Hampshire; the holders of the $2,720,000 of common stock of the Connecticut River Power Company of Maine shall receive $2,720,000 of second preferred stock of the New England Company; the holders of $5,000,000 outstanding stock of the New England Power Company of Maine shall receive $5,000,000 common

stock of the New England Company, and the holders of $670,000 preferred stock of the Bellows Falls Power Company shall be given an opportunity to exchange share for share for New England Company first preferred stock.

Calgary Power Annual Report.—In the annual report of the Calgary (Canada) Power Company, Ltd., for the year ended Dec. 31, 1914, Mr. Richard B. Bennett, the president, stated that out of the existing contracts for the sale of energy the company is assured of a minimum income sufficient to meet operating expenses and bond interest and still have a substantial surplus. The results for the year were not so good as anticipated, both gross and net earnings having been affected to the extent of about $27,500 by a fire which caused a suspension of operations for six months in the large cement mill at Exshaw, an important customer. Prevailing economic conditions prevented customers from taking as large amounts of energy as under normal conditions. The statement for the year follows:

Gross earnings	$231,186
Operating expenses	48,756
Office expenses, etc	2,223
Net earnings	$180,207
Deduct:	
Interest on bonds	150,000
Interest on floating debt	5,479
Net profit for year carried to surplus	$24,728

Pacific Gas & Electric Reviews Year.—The preliminary report of the Pacific Gas & Electric Company for 1914 shows that the business was well in advance of the previous years. The marked improvement in the condition of the company's current finances has been brought about in part through the application of surplus earnings, no dividends having been paid during 1914 except upon preferred stocks, and in part through the sale of a new issue of first preferred 5 per cent stock which was authorized by the Railroad Commission on July 1, 1914. To March 1, 1915, $9,356,400 par value of this stock had been sold to more than 4000 individual subscribers, netting the company $7,719,030. From the 1914 surplus a reserve of $534,362 was set up to cover revenue involved in litigation over gas rates in Sacramento and gas and electric rates in San Francisco. Of these three suits the one concerning gas rates in Sacramento was finally decided in the company's favor. The master in chancery of the United States District Court, San Francisco, also found for the company in the two San Francisco cases, his report now being before the court for final disposition. At present only the gas rates in San Francisco are in question, the city having, as of July 1, 1914, adopted an electric schedule satisfactory to the company. The amount of earnings in dispute in 1915 will, therefore, be relatively small.

Western Union Annual Report.—The annual report of the Western Union Telegraph Company for the year ended Dec. 31, 1914, stated that to conform with the requirements of the Interstate Commerce Commission's classification of accounts for telegraph companies, effective on Jan. 1, 1914, an inventory, priced at cost, was taken of all the replacement work in progress as of that date. The value of this work, amounting to $3,588,890, was added to construction work in progress, the reserve for depreciation of land lines being correspondingly increased. This reserve now stands at $5,576,242, an increase over the balance on Dec. 31, 1913, of $3,408,158. The company's gross operating revenues increased over those of the previous year by $1,475,900, due to unprecedented cable business during the last five months of the year, the land line earnings remaining approximately constant with 1913. The company's statement for 1914 follows:

Gross operating revenue	$46,264,777
Operating expenses including repairs, depreciation and taxes, etc.	40,578,751
Balance	$5,686,026
Income from loans and investment	1,022,611
Net revenue	$6,708,637
Bond interest	1,337,242
Balance transferred to surplus	$5,371,395
Surplus on Dec. 31, 1913	9,705,791
Other surplus reserve	3,451,922
Total	$18,529,108
Transferred to reserve for accrued depreciation	1,000,000
Miscellaneous adjustment	8,301
Dividends paid and declared	3,988,886
Surplus on Dec. 31, 1914	$13,531,921

Manufacturing and Industrial

The Western Chandelier Company, Kansas City, Mo., has moved into new quarters at Fourteenth Street and Grand Avenue.

The Western Lumber & Pole Company has moved its headquarters from 645 Electric Building, Denver, Col., to Spokane, Wash.

The Automatic Reclosing Circuit Breaker Company has moved from 197 North Front Street, Columbus, Ohio, to 31 West Mound Street.

Clark Electric Manufacturing Company.—Edwin G. Hatch has resigned as treasurer and manager of the Clark Electric & Manufacturing Company, New York.

The Oshkosh Manufacturing Company, Oshkosh, Wis., has appointed the H. B. Squires Company of San Francisco, Los Angeles and Portland as its representative on the Pacific Coast.

The American Manufacturers' Agency, Inc., Mr. William H. McKinlock, president, has taken the Chicago agency for the Union Electric Company's line of sockets, switches and attachment plugs. The American Manufacturers' Agency is at 111 West Monroe Street, Chicago.

The Adams-Bagnall Electric Company, Cleveland, Ohio, has opened a sales office at 417 South Dearborn Street, Chicago, Ill., which will be in charge of Mr. Van N. Marker. Mr. Marker has been identified with the company for a long time in the Northwestern territory.

Mr. R. M. Klein, who has been for some years sales manager of the Diehl Manufacturing Company, Elizabeth, N. J., announces his resignation, to take effect April 1. On his return from a Pacific Coast trip Mr. Klein will take up new work in an executive capacity with an enterprise in which he is interested.

Preparations for Special Selling Campaign.—The Hotpoint Electric Heating Company, Ontario, Cal., is making extensive preparations for its "Hotpoint week," May 3 to 8. The company will feature its new "El Grilstovo" during this period, and all its letterheads and envelopes contain illustrations of this device with the title "El Grilstovo at One-third Off, Hotpoint Week, May 3-8."

Bryan-Marsh Jobbers Entertained.—A number of jobbers who handle the products of the Bryan-Marsh Works of the General Electric Company, Chicago, were entertained by the officials of the company at a dinner at the Hotel Sherman, Chicago, March 19, following a conference between representatives of the manufacturer and the distributers. Mr. Ernest H. Haughton, general manager, presided, assisted by Mr. J. J. Corby, manager for the Chicago district.

Cooper Hewitt Company's New Publication.—*The Output* is the title of a new magazine issued by the Cooper Hewitt Electric Company, Hoboken, N. J. The first copy of this magazine was published March 17. Several interesting articles in this publication are "Lighting of the Craneways of the Ford Motor Company," by Mr. Fred Allison, electrical engineer Ford Motor Company; "Increasing Production," by Mr. A. S. Hubbard, and "Portrait Lighting with Cooper Hewitt Lamps," by Mr. M. B. Buckman, Jr.

Electric Company Enlarges Plant.—On account of the increase in business of the Connecticut Telephone & Electric Company, Meriden, Conn., it has been necessary to add another building to the plant which will cover an area 50 ft. by 100 ft. This building will have four floors and a basement and will be of brick-mill construction. The structure will be completed April 15, and will be used chiefly for the manufacture of ignition systems. This addition is the third made by the company within recent years.

Mr. A. G. Shaver has opened an office as consulting engineer at 1640 Transportation Building, Chicago, where he will give particular attention to work in railway signaling, telephone and electric power-plant construction, and the design of high-tension transmission lines. Mr. Shaver recently resigned as secretary of the Hallett Iron Works, manufacturers of line material and tools, Harvey, Ill. He was formerly signal engineer for the Chicago, Rock Island & Pacific and Union Pacific railroads and for the Hall Signal Company, New York.

The Adams-Bagnall Electric Company, Cleveland, Ohio, has appointed Mr. M. S. Knapp manager of the Pittsburgh district, with headquarters at 1430 Park Building, Pittsburgh, Pa. Mr. Knapp has been connected with the National Metal Molding Company the past year, and before that he was with the General Electric Company. He was city salesman in Pittsburgh for the latter company for six years.

Demand for Electrical Supplies in Pernambuco, Brazil.—According to Mr. H. N. Douthitt, a special agent of the Department of Commerce, there will soon be a demand for various electrical machines and devices in Pernambuco, Brazil. A new power house is being constructed. Three 1000-kw turbo-generators made by the British Westinghouse Company have already been installed, and a foundation is being made for a fourth machine. The boilers and boiler-room equipment were made by the Babcock & Wilcox Company.

The Spray Manufacturing Company, 201 Devonshire Street, Boston, Mass., has recently been formed and has branch offices in New York and Chicago. The company is making a specialty of manufacturing spray cooling ponds, spray air washers and gas scrubbers, and of various engineering applications of spray devices. Mr. A. G. Eneas, who organized and developed the Spray Engineering Company, has severed his connection with that company and has taken charge of the engineering department of the Spray Manufacturing Company.

Bauman & Loeb, Inc., 138 Bowery, New York, is the name of a concern recently incorporated. Mr. O. Bauman is president, Mr. William Loeb secretary, and Mr. H. B. Bauman treasurer. Mr. O. Bauman has been for the last fifteen years a traveling salesman in the electrical-fixture line, Mr. Loeb has been connected with an electrical supply house in the West, and Mr. H. B. Bauman has been connected with the United Electric Light & Power Company for a number of years. The above firm will be engaged as importers and jobbers of gas and electrical fixtures and appliances.

Exhibit of Cutter Circuit-Breakers.—The Cutter Electrical & Manufacturing Company of Philadelphia will exhibit a number of "I-t-e" circuit-breakers at the University of Illinois electrical show to be held at Urbana, Ill., April 8 to 10. Among the number will be a specially designed breaker for 1300-volt railway service. These breakers are equipped with protective devices which make them non-closable on overloads and also embody the direct-acting time-limit feature. Mr. Linn O. Morrow, manager of the company's Indianapolis office, will have charge of the exhibit.

The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has appointed Mr. Horace L. Dawson, formerly of its Chicago and Cincinnati offices, district sales manager of the Chicago territory, with headquarters in the People's Gas Building, Chicago. Mr. Dawson began work with the Cutler-Hammer Manufacturing Company in 1907. After completing the apprentice shop course he spent two years in the engineering department of the company and then joined the sales-engineering force of the Chicago office. When the Cincinnati office was established in 1913 Mr. Dawson was placed in charge. Mr. Dawson is a graduate of Cornell University, class of 1907.

The Avery & Loeb Electric Company, Columbus, Ohio, has been incorporated with a capital stock of $100,000 as a reorganization of the Avery-Loeb Electric Company, which has been in the electrical contracting and supply business for the past five years. The reorganization is for the purpose of securing additional capital for the development of the business, which is growing rapidly. The incorporators are Messrs. Oscar Avery, A. E. Loeb, C. W. Hammond, A. W. Loeb and A. L. Frey. It is reported that the directors and officers will be the same as in the original company, of which Mr. Oscar Avery was president, Mr. A. E. Loeb vice-president, and Mr. C. W. Hammond secretary-treasurer.

Vehicle Prospects Bright in West.—Returning from a trip to the Pacific Coast and Gulf States, in the course of which he visited twenty-seven principal cities in eighteen states, Mr. E. P. Chalfant, secretary of the Electric Automobile Manufacturers' Association, with offices at 910 South Michigan Avenue, Chicago, reports a revival in all classes of business in the territory visited, following a year of depression which seemed to close with 1914. The last two months show marked improvement in both electric and gasoline automobile sales in the West, declared Mr. Chalfant in a recent comment, adding that the Western people now see only bright days ahead. Mr. Chalfant has been working to effect closer co-operation between local central stations and dealers. In those cities where friendly interest and help exist the electric-vehicle business is thriving. By inculcating the spirit of co-operation, declared Mr. Chalfant, the electric-vehicle business is being converted from a game of barter and concession to the status of a real industry.

Price Reductions in Tungsten Lamps.—Practically all the sizes and types of Edison tungsten multiple lamps are affected by reductions in list prices that were put into effect April 1, 1915, by the Edison Lamp Works of the General Electric Company. On the regular straight-side and round-bulb lamps, from the 10-watt to the 250-watt size, also on sign lamps, stereopticon lamps, etc., the reductions range from 3 cents to 20 cents per lamp, according to the size. These reductions, which average about 10 per cent, will tend to popularize further already popular lamps. The new concentrated-filament vacuum lamps of 25-watt, 40-watt and 60-watt sizes now list at only 5 cents per lamp more than the regular lamps of corresponding sizes. On the gas-filled, multiple lamp of 100-watt to 1000-watt size the reductions range from 50 cents to $1 per lamp, the average reductions being between 20 and 25 per cent. The introduction of gas-filled lamps has been exceptionally rapid. More than a million are already in use. The decreased cost of these lamps will undoubtedly result in a still more rapid replacement of vacuum lamps by the more efficient gas-filled units.

Export of Tools.—The Oshkosh Manufacturing Company, Oshkosh, Wis., reports that it has recently received orders for electrical construction tools from Australian, South American and South African jobbers and also an order for a number of anchors for the Post Office Department of Australia for use on government lines. The company is also holding a large shipment of its products which will be sent in the near future to Manila, P. I. According to Mr. J. W. Wooley, sales manager of the above company, prospects for business in South America are excellent, inquiries are plentiful, and orders are being received more frequently than heretofore. The increasing export business of the company has made it necessary to establish an export department, which is in charge of Mr. E. H. Hoffman, who has had fifteen years' experience in the export field. Mr. Wooley states that no price reductions have been necessary, and in all cases regular prices plus packing and freight charges have been obtained and satisfactory credit arrangements made. Owing to the fact that, in many instances, tools have to be packed on mules or horses the packing item, Mr. Wooley stated, is one to be watched with the utmost care in order to make the cases as small in weight and bulk as is consistent with the necessary strength.

NEW YORK METAL MARKET PRICES

	March 22 — Selling Prices Bid	Asked	March 30 — Selling Prices Bid	Asked
Copper	£ s d		£ s d	
London, standard spot*	68 5 0		69 0 0	
Prime Lake	15.12½		16.25	
Electrolytic	15.12½		15.70	
Casting	14.37½		15.00	
Copper wire base	15.87½		16.75	
Lead	4.10		4.15	
Nickel	42.00 to 45.00		42.00 to 45.00	
Sheet zinc, f.o.b. smelter	13.50		13.50	
Spelter	9.75†		9.62½†	
Straits tin	53.50†		53.00†	
Aluminum, 98 to 99 per cent	18.75		18.75	

*OLD METALS

Heavy copper and wire	13.50	13.50
Brass, heavy	9.25	9.25
Brass, light	7.75	7.75
Lead, heavy	3.85	3.95
Zinc, scrap	7.50	7.50

COPPER EXPORTS*

Total tons to March 30 28,679

*From daily transactions on the New York Metal Exchange.
†Nominal.

New Incorporations

The Honaker Public Service Corporation, of Honaker, Va., has filed articles of incorporation with a capital stock of $5,000. The officers are: E. J. Boyd, president, and Aaron Russ, secretary and treasurer.

The Rankin Electric Light Company, of Rankin, Ill., has been incorporated with a capital stock of $5,000 by Charles Morrow, Charles J. Crump and Catherine Crump. The company proposes to generate and sell electricity for lamps and motors.

The Minnesota Electric Light & Power Company, of Duluth, Minn., has filed articles of incorporation with a capital stock of $1,500,000. The company proposes to generate and distribute electricity in the State of Minnesota; also to construct power plants, dams, reservoirs, canals and pipe lines.

New Industrial Companies

The Wrought Metals Products Company, of Buffalo, N. Y., has been incorporated by M. F. Dumble, H. R. H. Richards and J. H. German, of Buffalo. The company is capitalized at $15,000 and proposes to manufacture and deal in glass and electrical supplies.

The Witherbee Storage Battery Company, of Brooklyn, N. Y., has been incorporated with a capital stock of $10,000 to manufacture and deal in motors, engines, machinery, supplies, motor vehicles, etc. The incorporators are M. J. Hanlon, C. J. Steier and E. E. Jacobson, 68 Montague Street, Brooklyn, N. Y.

The New York Electrical Garage Corporation, of New York, N. Y., has been incorporated with a capital stock of $50,000 to do a general garage and automobile business, manufacture vehicles, engines, machines, etc. The incorporators are I. W. Donner, R. R. Livingston and J. W. Crandall, 165 Broadway, New York, N. Y.

Ricketts & Company, of New York, N. Y., have been incorporated by P. F. Cowing, 195 Claremont Avenue, New York, N. Y.; T. H. Burnett, 177 West Eighty-seventh Street, New York, N. Y., and R. B. Cowing, Glen Ridge, N. J. The company is capitalized at $50,000, and proposes to do a general mining, metallurgical and chemical engineering business.

Trade Publications

Cable and Wire.—The American Electrical Works, Philipsdale, R. I., is sending out a price list of its products.

Catenary Material.—The Ohio Brass Company, Mansfield, Ohio, is sending out a bulletin which describes its O-B catenary material.

Wireless Apparatus.—The Mignon Wireless Corporation, Elmira, N. Y., has prepared several bulletins which describe various types of radio apparatus.

Steam-Recording Meter.—Bulletin No. 800 issued by James G. Biddle, 1211 Arch Street, Philadelphia, Pa., describes the "Curnon" steam meter.

Motor Controller.—M. Taigman, 239 Wooster Street, New York, has issued a bulletin which describes a 110-volt starter and speed regulator for small motors.

Household Appliances.—"Electric Household Appliances" is the subject of a folder recently issued by the General Electric Company, Schenectady, N. Y.

Water Weigher.—The Kennicott Company, Chicago Heights, Ill., is sending out a leaflet which directs attention to the advantages of a water weigher.

Electric Trucks.—The Connersville Buggy Company, Connersville, Ind., is sending out a booklet which describes its light-weight electrically operated trucks.

Outdoor Metering Outfits.—Bulletin No. 46,251 recently published by the General Electric Company, Schenectady, N. Y., describes its outdoor metering outfits.

Vacuum Cleaner.—The Innovation Electric Company, 585 Hudson Street, New York, has prepared a folder which describes and illustrates its "Liberty" cleaner.

Electric Fans.—The Lindstrom, Smith Company, Chicago, Ill., is sending out a folder which describes its No. 60, No. 61, No. 62 and No. 63 electrically operated fans.

Flashlamps.—The Interstate Electric Novelty Company, 29 Park Place, New York, is sending out a booklet which describes a number of different kinds of flashlamps.

Steam Traps.—Catalog No. 8, entitled "Barton Expansion Automatic Steam Trap," has just been published by the Automatic Steam Trap & Specialty Company, Detroit, Mich.

Tubular Flashlamps.—The Interstate Electric Novelty Company, 29 Park Place, New York, has published several leaflets which describe its tubular flashlamps shaped like a fountain pen.

Armored Conductors.—M. B. Austin & Company, Chicago, Ill., are sending out Loose Leaf No. 64, which contains information on their steel-armored conductors and flexible-steel conduit.

Refractory Material.—The La Clede Christy Clay Products Company, Manchester and Sulphur Avenues, St. Louis, Mo., is sending out a card which directs attention to some of its products.

Electrically Operated Ice-Cream Freezer.—The Emery Thompson Machine & Supply Company, 235 East Forty-first Street, New York, has published a catalog describing its motor-driven brine ice-cream freezer.

Small Motors.—The Bodine Electric Company, 564 West Randall Street, Chicago, Ill., is sending out a card which illustrates and describes its type C fractional-horse-power alternating-current and direct-current motors.

Porcelain Sockets.—The Weber Electric Company, Schenectady, N. Y., for which Henry D. Sears, 131 State Street, Boston, Mass., is general sales agent, has issued a folder describing its recently developed porcelain sockets.

Wireless Apparatus.—Bulletin A 15 just issued by the DeForest Radio Telephone & Telegraph Company, 101 Park Avenue, New York, describes and illustrates audion detectors, variometers and an audion time receiver.

Small Electric Stove.—The Hotpoint Electric Heating Company, Ontario, Cal., has issued an illustrated folder which describes its new "El Grilstovo" and gives details of a special selling campaign to dispose of this device.

Lighting Fixtures.—The New York Gas & Electric Appliance Company, 569 Broadway, New York, is sending out a leaflet which describes and illustrates a shower fixture and also a folder which directs attention to its new Catalog No. 18.

Blower and Exhauster Fans.—The Buffalo Forge Company, Buffalo, N. Y., has recently issued Catalog No. 200, entitled "Planoidal Fans," Catalog No. 201, entitled "Niagara Planoidal Fans," and Bulletin No. 182 E, entitled "Buffalo Electric Fans for Blowing, Exhausting, Ventilating, Cooling and Drying."

Clamps.—"Facts for the Engineer and Technical Man" is the title of a folder just issued by the Steel City Electric Company, 1207 Columbus Avenue, Pittsburgh, Pa., which directs attention to the results of several tests on its "Marchand" clamps. Another folder, entitled "Marchand Clamps," describes and illustrates this device.

Lighting of Billboards and Large Painted Signs.—The National Lamp Works of the General Electric Company, Cleveland, Ohio, have just issued a bulletin entitled "Lighting of Billboards and Large Painted Signs," in which the subject of glare is discussed and data for its elimination are set forth. Distribution curves for various types of units and illumination curves taken on a test board are shown.

The Western Electric Company, New York, has just issued the following booklets: "Temco Portable Electric Tools," "Reflectors for Roundhouse and Industrial Plant Lighting," "Summer Breezes" on electrically operated fans, and "Dishes and Drudgery." The company has also recently prepared leaflets and folders on its desk telephone, No. 6003; magneto telephone, No. 1317; washing machines, vacuum cleaners, inter-phone outfit, No. 17; D & W fuses, friction tapes, electric lantern, Bryant receptacles and plugs, Temco electric portable drill, electric fans and D & W oil fuse cut-outs.

Construction News

New England

AUGUSTA, MAINE.—Within the next nine months the Central Maine Pwr. Co., of Augusta, expects to purchase material for distribution and lighting system, involving an expenditure of not more than $40,000; also electrical appliances, including heating and cooking apparatus, vacuum cleaners, etc., and electrical supplies, to cost not more than $35,000. W. S. Wyman is treasurer.

WATERVILLE, MAINE—The City Council is reported to be considering the installation of a municipal electric-light plant. Eugene W. Crawford is city engineer.

EAST KINGSTON, N. H.—The Exeter & Hampton El. Co., of Exeter, has been granted a franchise to extend its transmission lines to East Kingston to furnish electrical service here.

EXETER, N. H.—The Selectmen have been authorized to make a new contract with the Exeter & Hampton El. Co. whereby the present arc lamps, of which there are 75, will be replaced with 78 tungsten lamps of 250 cp, with prismatic refracting globes, and the 77 60-cp tungsten lamps now in use will be replaced by 91 tungsten lamps of 60 cp.

WOODSTOCK, N. H.—The town of Woodstock has petitioned the Legislature for an amendment to its charter giving the town authority to construct and operate a municipal electric-lighting plant.

PALMER, MASS.—The Central Massachusetts El. Co., of Palmer, is contemplating the installation of a distributing system in the town of Granby. H. Parsons is general manager.

READING, MASS.—The town of Reading has appropriated $4,000 for extensions and improvements to the municipal electric-lighting plant.

ROWLEY, MASS.—Within the next two months the electric-light commissioners expect to purchase transformers, poles, lightning arresters, insulators, meters, tub transformers, etc. S. O. Kent is manager.

TAUNTON, MASS.—Preparations are being made by Leland D. Wood, manager of the municipal electric-lighting plant, for the erection of an electric transmission line in Oakland, for which an appropriation of $3,500 has been made.

HARTFORD, CONN.—Negotiations are under way for the sale of the property of the Hartford & Springfield St. Ry. Co., which operates two suburban railways between these two cities on both sides of the Connecticut River, with branches to Suffield on the west and Rockville on the east, to the Northern Connecticut Lt. & Pwr. Co. The latter company is to distribute electricity to be generated by the hydroelectric plant at Windsor Locks, when the Northern Securities Co. obtains a federal charter for its dam.

WINDSOR LOCKS, CONN.—The Northern Connecticut Lt. & Pwr. Co., of Windsor Locks, has applied for permission to increase its capital stock from $500,000 to $1,000,000, the proceeds to be used for extensions to its system.

Middle Atlantic

GREAT BEND, N. Y.—The Village Board has acted favorably on the petition asking that a lighting zone for electric lamps be granted. The service, it is understood, will be furnished by the Watertown Lt. & Pwr. Co., of Watertown.

LA FARGEVILLE, N. Y.—The Village Board has granted the Hydro-Electric Pwr. Co., of Theresa, a franchise to extend its transmission line into La Fargeville to supply electrical service here. F. L. Santway is president and manager of the company.

RAQUETTE LAKE, N. Y.—Kamp Kill Kare, at Lake Kora, owned by the late Timothy L. Woodruff, has been purchased by F. P. Garvin, of New York. The new owner, it is understood, will install an electric-lighting plant.

RIVERHEAD, N. Y.—The Riverhead El. Lt. Co. expects to erect within the next 30 days a brick power house (contract already awarded); also to install a 140-kw, two-phase, 2300-volt generating unit (directly connected), which has already been purchased. Robert P. Griffing is president.

SILVER SPRINGS, N. Y.—The Village Board has entered into a contract with the Warsaw Gas & El. Co., of Warsaw, to furnish electricity to operate the municipal electric-light plant.

SPENCERPORT, N. Y.—The town of Parma has granted to the Hilton El. Lt. & Pwr. Co., of Hilton, a franchise to extend its lines throughout the town to furnish electrical service there.

STANLEY, N. Y.—The Empire Gas & El. Co., of Geneva, has decided to extend its transmission lines to Stanley to furnish electrical service here. This extension will include the erection of 4 miles of pole line from Hall Road into Stanley. The proposed line will carry 6600 volts, and provision will be made so that it can be continued to Gorham and Rushville if desired.

SYRACUSE, N. Y.—The Oswego River Pwr. Trans. Co., of Syracuse, may purchase a few transformers and meters during the next 12 months.

WATERTOWN, N. Y.—Work has begun on the city's power-development project on the Black River.

ALLENTOWN, PA.—The Lehigh Valley Lt. & Pwr. Co. is contemplating extending its transmission lines to supply electricity in the towns of Schnecksville and Neffs, about 12 miles distant. The high-tension lines furnishing energy to the slate regions will be tapped through an outdoor substation midway between the two stations.

ALLENTOWN, PA.—The Allentown & Reading Trac. Co. has abandoned its power plant at Greisemersville and will secure energy to operate its cars from the Lehigh Valley Lt. & Pwr. Co. The generating plant at Kutztown, which supplies electricity in the district between that town and Reading, will be kept in operation. This plant will also supply alternating current for lighting Dorney Park, which is owned by the railway company.

BEDFORD, PA.—The Bedford El. Lt., Ht. & Pwr. Co. expects to install two 175-hp horizontal tubular boilers this spring. William Brice, Jr., is manager.

CRESSON, PA.—The Cresson El. Lt. Co. will replace the arc lamps now in use with 250-cp nitrogen (General Electric) lamps, using fixtures with concentric reflectors and holophane globes. A. G. Edwards is secretary and treasurer.

ERIE, PA.—The Erie Ltg. Co., of Erie, is erecting a 33,000-volt, three-phase, 60-cycle transmission line between Erie and Corry. When completed the line will supply electricity in Waterford, Union City, Corry and vicinity. Substations will be erected at each of the above towns; the building to be erected at Union City will be used as a combined showroom, office and substation.

HANOVER, PA.—The borough school board has been authorized to erect a new high school building, to cost about $85,000. Electric lamps and other electrical equipment will be installed.

HARRISBURG, PA.—Preliminary steps have been taken toward the installation of electric lamps on the River Front wall. An ordinance will probably be introduced in the City Council authorizing the placing of 54 standards for electric lamps along the wall.

HIGHSPIRE, PA.—The installation of a new street-lighting system in Highspire is under consideration. The question of obtaining electricity to operate same from the York Haven Wtr. & Pwr. Co. is also under consideration.

HOLLSOPPLE, PA.—The borough of Benson is installing an electric distributing system. Electricity to maintain same will be supplied by the Penn Lt. & Pwr. Co., of Altoona. The White Oak Lt., Ht. & Pwr. Co., of Hollsopple, which furnishes electrical service in this borough, has recently petitioned the Public Service Commission to restrain the borough from constructing the plant.

PITTSBURGH, PA.—The Philadelphia El. Co., of Pittsburgh, is extending its transmission lines to Ambridge with a view of furnishing energy to the plant of the Standard Seamless Tube Co. for lamps and motors. Rights-of-way are now being secured through Harmony and Economy Townships.

CLINTON, N. J.—Bids will be received by the board of managers of the State Reformatory for Women, Clinton, until April 9 (extension of date from March 5), for erection of electric transmission lines. Plans and specifications are on file with the commissioner of charities and corrections, Trenton, N. J.

GLOUCESTER CITY, N. J.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 20, for construction, complete (including mechanical equipment), of the receiving building for the Philadelphia (Pa.) immigration station, Gloucester, N. J. Drawings and specifications may be obtained from the commissioner of immigration at Gloucester City, or at the above office.

HARRISON, N. J.—Tentative plans are being prepared by the lighting committee of the Common Council for the installation of a new street-lighting system on Harrison Avenue.

PARK RIDGE, N. J.—The Board of Light Commissioners expects to purchase for the municipal electric-lighting plant one gas or oil engine and a friction-driven pulley for running the alternator from two different prime movers; also to purchase 500 cross-arms, 100 poles, and other small apparatus as required and some wiring supplies. E. Vernon Smith is superintendent.

PRINCETON, N. J.—The Borough Council has voted to sell the municipal underground conduit system to the Pub. Ser. El. Co., under the terms of which the company has agreed to place its overhead wires in the business district on Nassau Street underground.

LAUREL, MD.—Plans are being prepared by Harry Stevens, engineer, Union Trust Building, Washington, D. C., for improvements to electric-lighting, water and sewer systems, to cost about $75,000.

MOUNT AIRY, MD.—The Public Service Commission has approved the franchise granted the Mount Airy Ice & El. Co. by the Mayor and City Council to furnish electricity in the town for lamps and motors.

LEXINGTON, VA.—Plans are being considered by the Blue Ridge Pwr. Co., a subsidiary of the Virginia Western Pwr. Co., of Clifton Forge, for the construction of hydroelectric plant at Balcony Falls on James River. W. C. Mathews, of Clifton Forge, is president.

WASHINGTON, D. C.—Bids will be received at the office of the chief officer of the War Department, Washington, D. C., until April 20, for 127 miles of cables. Specifications may be obtained at the above office.

WASHINGTON, D. C.—Bids will be received at the depot quartermaster's office, Washington, D. C., until April 12, for furnishing 66 electrically connected portable gasoline electric generating sets. Further information may be obtained upon application to the above office. J. B. Houston is depot quartermaster.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until April 20, under Proposal 749, for furnishing 12 miles of intermediate cable, special; 15 miles of intermediate cable, type 44; 50 miles of deep-sea cable, type 45, and 50 miles of deep-sea cable, special. For further information address Charles S. Wallace, captain, Signal Corps, U. S. A.

WASHINGTON, D. C.—Foreign trade opportunities are announced by the Bureau of Foreign and Domestic Commerce in the Commerce Reports as follows: No. 16,074—This bureau is in receipt of a communication from a business man in the United Kingdom who desires to secure agencies for the sale of American machinery in that country. He states that he has had several years' experience in the sale of hydraulic machinery, engineering machinery, railway and tramway supplies. No. 16,081—An American consul in the Far East reports that a firm in his district is desirous of securing full information relative to lathes for finishing metals, steam-power machines, steam boilers, kerosene engines, equipment and apparatus for steam-heating iron pipes, steel and other tools, instruments, etc. No. 16,059—An American officer in Russia reports that a lumber dealers' association in his district desires to receive catalogs, etc., from manufacturers of turbines. It now has in view the purchase of a 150-hp waterwheel. Correspondence may be in Russian, French or German. For further information address the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., and its branches. No. 16,118—An American consular officer in Russia reports that a business man in his district desires to represent American firms for the sale of electrical supplies, oil engines, etc. Correspondence should be in Russian or German.

North Central

CLARE, MICH.—The proposal to issue $34,000 in bonds for the installation of a municipal electric-light plant in Clare will be submitted to the voters on April 5.

CLEVELAND, OHIO.—A resolution recommending the purchase of the entire system of the Cleveland El. Ltg. Co. by the city of Cleveland has been submitted to the City Council.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, 511 City Hall, Cleveland, until April 9, for furnishing un-

derground lead cables for the department of fire. Specifications may be obtained at the office of the director of public safety, 207 City Hall. A. R. Callow is commissioner of purchases and supplies.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, 511 City Hall, Cleveland, until April 9, for switchboard apparatus and electrically operated high-tension oil switches for substation for the municipal electric light department. Specifications may be obtained at the office of the commissioner of light and heat division, 1443 East Third Street.

DAYTON, OHIO.—The general contract for the construction of the men's dormitory, including electrical and other work, at the County Infirmary by the County Commissioners, will be let on April 14.

GALLIPOLIS, OHIO—The Gallipolis & Northern Trac. Co. expects to close its power house in East Gallipolis after May 1 and purchase energy from the Gallipolis El. & Pwr. Co., of Gallipolis.

GREENVILLE, OHIO. — The capital stock of the Greenville El. Lt. & Pwr. Co. has been increased from $155,000 to $180,000, the proceeds to be used for extensions and improvements to its plant.

HAMILTON, OHIO.—Contract has been awarded by C. A. Irvin & Co. for the construction of a cold-storage plant, warehouse, offices and other buildings for the use of the Wiedemann Brewing Co., of Newport, Ky. Motors and other electrical equipment will be required.

LOCKLAND, OHIO.—The Council is negotiating with the Union Gas & El. Co., of Cincinnati, for the renewal of the street-lighting contract, which, it is understood, will be changed to provide for additional street-lighting equipment.

LORAIN, OHIO.—Preliminary plans have been prepared by the City Councils of Lorain and Elyria for a joint municipal electric plant to serve the two towns. A bill is being prepared by George Wickens, councilman, of Lorain, enabling the establishment of such a plant. The bill will be introduced in the Legislature by Senator Stone within a short time.

MONROEVILLE, OHIO.—The Board of Public Affairs is contemplating the installation of a filtration plant in connection with the municipal water-works system.

PORTSMOUTH, OHIO—Plans are being prepared by the Ohio Valley Trac. Co., of Portsmouth, for the construction of three substations, to be situated at Franklin, Furnace and Hanging Rock.

ST. MARY'S, OHIO.—The Village Council, it is reported, has voted to sell the municipal electric-light plant.

TIFFIN, OHIO—The Ohio Lt. & Pwr. Co., it is reported, will soon begin work on the erection of a high-tension steel-pole transmission line between Newark and Thornville, the cost of which is estimated at about $150,000. The company proposes to furnish electricity to towns and villages along the line.

YOUNGSTOWN, OHIO—The City Council has passed an ordinance granting the Mahoning County Lt. Co., of Youngstown, an extension of time to complete its plant to Sept. 1, 1916.

COLUMBIA, KY.—Within the next six months the Columbia Ltg. Co. expects to install a 30-kw, 1150-volt, 60-cycle alternating-current generator and a 40-hp or 50-hp kerosene engine. A. H. Ballard is secretary and treasurer.

DAWSON SPRINGS, KY.—The Dawson Lt. & Pwr. Co. is building an addition to its power house and installing a 100-kw generator belted to a 150-hp Skinner engine. The company is installing a three-wire system. E. A. Stevens is manager.

DIXON, KY.—Plans are being considered by Melton & Melton, proprietors of a local mill, for the installation of an electric-lighting plant to furnish electrical service in this vicinity. The Clay Lt. & Ice Co., of Clay, has submitted a proposal to erect a transmission line to supply local needs. A committee has been appointed to consider both propositions.

ELIZABETHTOWN, KY. — The Kentucky Utilities Co. is installing Nicholson furnaces under the boilers in its power plant and erecting a transmission line about 1½ miles out of town to supply electricity to farms and residences in that vicinity. J. P. Todd is local manager.

PRESTONBURG, KY.—The Prestonburg El. Lt. Co., it is reported, is contemplating the erection of a 11,000-volt, three-phase transmission line from Van Lear to Prestonburg, a distance of 8 miles. Contract, it is understood, will soon be awarded. For further information address L. L. Stone, manager of the Sandy Valley Lt. & Pwr. Co., Pikeville, Ky.

JEFFERSONVILLE, IND.—Bids will be received by John J. Snyder, city clerk, Jeffersonville, until May 1 for furnishing the necessary appliances and energy for lighting the streets and public places of the city of Jeffersonville. For details see proposal columns.

VEEDERSBURG, IND.—Within the next two or thee months the Board of Public Works expects to purchase one 100-hp to 125-hp horizontal center-crank engine. W. T. Armstong is superintendent.

VINCENNES, IND.—The City El. Ltg. Co., of Vincennes, controlled by W. S. Barstow & Co., 50 Pine Street, New York, N. Y., expects to puchase within the next two months two 72-in. by 18-in. horizontal tubular boilers (160 lb. working pressure), breeching, stack (48 in. by 90 ft.), and to make sundry boiler-room changes; also to purchase 60 ornamental lamp-posts for five-lamp clusters, cable, etc. Felix L. Cadou is general manager of the City El. Ltg. Co.

CHICAGO, ILL.—Bids will be received by the clerk of the Sanitary District of Chicago, Room 700, 910 South Michigan Avenue, Chicago, until April 8 for electrical apparatus, including tubular steel poles, ornamental bases, lamp hangers, insulators, cross-arms, lamp brackets, lamp hoists, single-conductor, four-conductor and eight-conductor lead-covered cable, single-conductor, armored cable, multiple-conductor, 12,000-volt cable, cast-iron pole tops, lamps, globes, etc. For details see proposal coumns.

GIBSON CITY, ILL.—Steps have been taken by the Commercial Club for the installation of ornamental lamps along three blocks of the business section.

MARTINTON, ILL.—Preliminary steps have been taken to organize a stock company for the purpose of establishing an electric-light plant in Martinton. A committee, consisting of Thomas McSorley, J. H. Peltier, William Baron and Thomas Hennegan, was appointed to secure a charter.

NASHVILLE, ILL.—The Nashville El. Lt. Co. has been granted permission by the Illinois Public Utilities Commission to erect a transmission line from Nashville to Addieville.

GREEN BAY, WIS.—Within the next 30 days the Wisconsin Pub. Ser. Co., of Green Bay, expects to purchase material for 7 miles of 26,000-volt transmission line. C. R. Phenicie is general superintendent.

MANITOWOC, WIS.—The capital stock of the Oslo Pwr. & Lt. Co., of Manitowoc, it is reported, has been increased from $5,000 to $30,000, the proceeds to be used for rebuilding its hydroelectric power plant, which was damaged by the floods a few months ago. A. O. Anderson is president.

HIBBING, MINN.—The Water and Light Commission is erecting a high-tension transmission line, 4 miles long, and expects to purchase some time this summer two new engines and generators, 700 kw each; also some new transformers. C. B. Waymire is superintendent of the Water and Light Department.

REDWOOD FALLS, MINN.—R. F. Wherland, secretary and manager of the Wherland El. Co., of Redwood Falls, has sold his interest in the Wherland company to Alfred Green, of Morgan.

WILLMAR, MINN.—The town of Willmar expects to install a boiler of about 200 hp, and possibly a superheater, this year. N. W. Larson is superintendent.

CENTRAL CITY, IA.—The El. Ser. Co., of Central City, successor to the Wausiponicon Pwr. Co., expects to erect within the next six months from 30 to 40 miles of transmission lines to connect the towns of Ryan, Coggon, Shellsburg and Alburnett with its system; also to purchase material for the above transmission lines and distribution systems. F. J. Cross is president and manager.

DES MOINES, IA.—The Des Moines El. Co. has submitted to the City Council its plan of franchise for a central heating system in the business district, under which it agrees to be ready to supply heat by Oct. 1 if granted a franchise by June 1. W. H. Thomson is general manager.

KNOXVILLE, IA.—Within the next four months the Marion County El. Co., of Knoxville, expects to erect 16 miles of 13,000-volt transmission line; also to purchase transformers, lightning arresters, meters, etc. H. Bellamy is secretary.

LARCHWOOD, IA.—Bids will be received by W. F. Ashton, town clerk, Larchwood, until April 21 for furnishing material and construction of an electric-light system as follows: (1) Cement block building; (2) oil engine, generator, storage battery, switchboard; (3) electrical distribution system. Bids to be submitted on complete parts only. Plans and specifications are on file in the office of the town clerk and also in the office of Earle D. Jackson, consulting engineer, Capitol Bank Building, St. Paul, Minn.

MARSHALLTOWN, IA.—The Iowa Ry. & Lt. Co., it is reported, has appropriated $25,000 for improvements and extensions to its local system.

MOUNT PLEASANT, IA.—The Board of Public Works expects to erect within the next three months three 72-in. by 18-ft. boilers in the municipal electric-light plant.

ROSE HILL, IA.—Bids, it is reported, are being received by A. L. Zink, representing the City Council, for the construction and operation of an electric-light plant in Rose Hill.

WAVERLY, IA.—Plans are being considered for extensions to the municipal electric-lighting and water-works system, to cost about $25,000.

ASH GROVE, MO.—The property of the Ash Grove Milling & El. Co. has been purchased by R. R. Jackson and E. E. Kemper for $25,000.

CLARKSBURG, MO.—At an election held recently the proposal to grant a franchise to G. P. Wilson to construct and operate an electric-lighting system in Clarksburg was carried.

GRAHAM, MO.—A special election has been called to vote on the proposal to grant the Mound City El. Lt. & Ice Co., of Mound City, a franchise to supply electricity in Graham; also to enter into a contract for street-lighting.

INDEPENDENCE, MO.—Within the next four months the Board of Public Works expects to install a 250-hp Allis-Chalmers cross-compound engine in the municipal electric-light plant. Henry Z. Berge is superintendent.

BISMARCK, N. D.—Bids will be received by T. E. Flaherty, auditor, until April 7 for an electric-light plant for court house and jail and for ornamental lighting system around court house grounds.

BEATRICE, NEB.—A petition is in circulation asking that an election be called to submit the proposal to issue $20,000 in bonds for the installation of a municipal electric-light plant in Beatrice.

BROKEN BOW, NEB.—The proposal to issue $10,000 in bonds for the installation of a municipal electric-light plant will be submitted to the voters at an election to be held April 9. Charles F. Sturtevant, of Holdrege, is engineer.

COLUMBUS, NEB.—The City Council is considering the adoption of a new street-lighting system in the business district. Several proposals have been submitted by the Columbus Lt., Ht. & Pwr. Co., one of which provides for the installation of 135 lamps of 100 cp, to be placed on iron poles, to cost about $35,000.

SUPERIOR, NEB.—The property of the Superior El. Lt. Co. has been taken over by the Southern Nebraska Pwr. & Devel. Co., of Superior, recently incorporated. The new directors are David Guthrie, H. C. Johnston, G. L. Day, C. W. Harvey and Margaret Johnston.

VALLEY, NEB.—The village of Valley has entered into a contract with the Station Engineering Co. to purchase energy to operate the municipal electric system for a period of 10 years. The company proposes to erect a transmission line this summer to connect up a number of towns in this vicinity. Within the next seven months the village of Valley expects to purchase transformers, lightning arresters, wire and meters (all for repair works). Albert C. Hedberg is village clerk.

BURRTON, KAN.—The Arkansas Valley Interurban Ry. Co., of Wichita, is reported to have decided to install an electric plant in Burrton in connection with its interurban system. The plans provide for an expenditure of about $20,000, which includes furnishing electricity for lamps and motors here.

CHAPMAN, KAN.—At an election to be held soon the proposal to issue $10,000 in bonds for the installation of a municipal electric-plant will be submitted to the voters. The city may purchase the local plant and enlarge and improve same.

GENESEO, KAN.—At a special election to be held April 5 the proposal to issue bonds to purchase and improve the local electric-lighting system will be submitted to the voters.

OSAWATOMIE, KAN.—The contract for new electrical equipment for the municipal electric-light and water plant has been awarded to the Westinghouse El. & Mfg. Co. for pumps to Henry R. Worthington, for engine to Hadley Hudson Machinery Co., and for boilers to Merkle Hines Machinery Co.

PRATT, KAN.—Bids will be received by the city of Pratt addressed to M. P. Jones, city clerk, Pratt, until April 20 for construction and furnishing equipment for an electric-light plant and distributing system

under one general contract as follows: Steam engines (160-hp and 240-hp), two 72-in. by 20-ft. oil-burning boilers, etc.; one 125-kva and one 187-kva alternator, four-panel switchboard and 15-kw regulator, power house, pressed-brick building and spray pond; distributing system, 850 poles, 48 miles of wire, 160 lamp brackets, 94 ornamental posts and 27 transformers. Plans and specifications are on file at the office of the city clerk, Pratt, and at the office of E. T. Archer & Co., engineers, New England Building, Kansas City, Mo. Copies of specifications may be obtained from engineers upon payment of $5. Bids will be considered for the entire plant only.

TOPEKA, KAN.—A petition has been presented to the City Council asking that the proposal to issue bonds to build an electric plant to supply electricity for commercial and power purposes be submitted to the voters.

WELLSVILLE, KAN.—The Wellsville El. Lt. & Pwr. Co. will install two 25-hp motors in the elevator of the Star Grain & Lumber Co. in Wellsville, to replace the steam plant. The installation will also include one or two small motors to care for drainage and seepage water, and probably to operate a small elevator and also an electric-lighting system for the elevator building. The company also plans to furnish a 24-hour service for the summer, which it hopes to continue permanently. C. A. Smith is owner and manager.

WILSON, KAN.—The town of Wilson may possibly purchase within the next six months a 150-hp oil engine and generator (directly connected), and will also require ammeters to mount on switchboard in place of smaller instruments. J. H. Williams is superintendent.

Southern States

DURHAM, N. C.—Bids will be received by the Mayor and Board of Aldermen of the city of Durham, City Hall, Durham, until April 21 for equipment for pumping station, consisting of 3,000,000-gal. crank and flywheel pumping engines, turbine-driven centrifugal pumps, open feed-water heaters, one 5-kw and one 7½-kw direct-current lighting unit and Manning boilers. Specifications and proposal forms may be obtained upon application to Gilbert C. White, engineer, Charlotte, for which a deposit of $10 will be required, to be refunded upon return of same.

KENLEY, N. C.—The Buckhorn Pwr. Co. is reported to have been granted permission to extend its electric transmission lines into the town of Kenley, connecting with the main line at Pine Level, about 7 miles from here.

SPENCER, N. C.—Preparations are being made by the city of Spencer for the installation of a municipal electric-lighting system. Electricity for operating the system will be purchased from the Southern Pwr. Co., of Charlotte. The plans provide for 60 street lamps.

WILMINGTON, N. C.—Bids will be received at the office of the supervising architect, Washington, D. C., until April 19 for construction complete, including mechanical equipment, of medical officers' quarters at the United States marine hospital, Wilmington. Drawings and specifications may be obtained at the above office.

ATHENS, GA.—Plans are being considered, it is reported, by G. W. Phelps and R. Clitz, of Athens, for the erection of a transmission line to furnish electricity for lamps and motors in Lexington, Comer and Crawford, Ga., from the generating station of L. F. Edwards at Watson Shoals.

GERMANTOWN, TENN.—The town of Germantown has petitioned the Legislature for authority to issue $2,000 in bonds for an electric-light plant.

MADISONVILLE, TENN.—The installation of an electric-light plant in Madisonville is under consideration.

MEMPHIS, TENN.—Bids will be received by the Mississippi River Commission, First and Second Districts, Custom House, Memphis, Tenn., until April 12 for furnishing about 750,000 lb. of galvanized wire, silicon bronze wire, wire strand and staples, and about 36,000 wire rope clips. Further information may be obtained upon application to E. M. Markham, major engineers.

SHELBYVILLE, TENN.—The plant of the Duck River Pwr. Co. was recently badly damaged by fire, causing a loss of about $15,000. The property was recently purchased by the Tennessee River Pwr. Co., of Chattanooga.

TRIMBLE, TENN.—The installation of an electric-lighting plant in Dublin is under consideration. J. W. Dulin is reported interested in the project.

BIRMINGHAM, ALA.—The installation of an ornamental lighting system on Twenty-first Street is being promoted by W. N. Malone.

ARKANSAS CITY, ARK.—The Lambe & Denmarke Lt. & Wtr. Co., it is reported, has purchased the local water-works system. The company proposes to obtain a franchise to install an electric-light system and to rebuild the pumping plant. The plans provide for an oil-engine-driven plant. The cost of the work is estimated at about $50,000.

BENTON, ARK.—Plans have been completed by the J. B. McCrary Co., of Atlanta, Ga., for the construction of water, lighting and sewerage systems for the city. An election will soon be called to vote upon a bond issue of $100,000 for same.

GURDON, ARK.—At an election to be held April 6 the proposal to issue bonds for the installation of a municipal electric-light plant and water-works system will be submitted to the voters. Plans and specifications were prepared by Albert C. Moore, consulting engineer, Bartlett Building, Joplin, Mo.

McGEHEE, ARK.—At an election to be held May 1 the proposal to issue $65,000 in bonds for the installation of an electric-light plant and water-works system will be submitted to the voters.

MANDEVILLE, LA.—Bonds to the amount of $80,000, it is reported, have been authorized by the stockholders of the St. Tammany & New Orleans Ry. & Ferry Co., the proceeds to be used for the construction of a power house in Ozona in St. Tammany Parish and equipping the railway for electrical operation.

ARDMORE, OKLA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D .C., until April 28, for the construction, including mechanical equipment, lighting fixtures and approaches, of the United States post office and court house at Ardmore, Okla. Drawings and specifications may be obtained at the above office.

BUTLER, OKLA.—At an election to be held April 6 the proposal to grant Cooper Davis a franchise to install and operate an electric-lighting plant in Butler will be submitted to the voters.

FOSS, OKLA.—Within the next three months the town of Foss expects to purchase 75 meters, one 75-kw transformer and one 7½-hp motor.

HOLDENVILLE, OKLA.—The Holdenville Ice & El. Co. has recently purchased a General Electric 75-kw, three-phase, 60-cycle, 2300-volt (belted) alternator, to replace a 75-kw, single-phase machine. Henry M. Dunn is secretary.

KINGSTON, OKLA.—At an election to be held April 6 the proposal to grant a franchise to George F. Blenkin, of Mansfield, to install an electric-lighting system in Kingston will be submitted to the voters.

MUSKOGEE, OKLA.—Bids will be received at office of Indian Affairs, Department of Interior, Washington, D. C., until April 28 for construction of frame hospital, quarters, laundry, lavatory, power house, camp quarters, water and sewer systems and electric-lighting plant for the Choctaw Sanatorium, Oklahoma. Plans and specifications may be examined at the United States Indian warehouses at Chicago, Ill., St. Louis, Mo., and Omaha, Neb., and at the office of the superintendent of the Five Civilized Tribes, Muskogee. Cato Sells is commissioner.

FLORESVILLE, TEX.—A franchise has been granted to B. J. Canco and others, of Fort Wayne, by the City Council to construct an electric-light plant in Floresville, to cost about $13,000. A company will be organized under the name of the Floresville Lt. & Pwr. Co. to operate the system. The company will supply power to operate the municipal water-works system and will furnish 30 street lamps.

JEFFERSON, TEX.—The City Council has awarded the Jefferson Ice & Lt. Co. a contract for increasing the number of street lamps; also for installing 100-cp lamps in the business district and 50-cp lamps in the residence section of the city, to be erected on brackets. The company, it is said, will erect a separate circuit and establish a day service.

KINGSVILLE, TEX.—The Texas Southern El. Co., of Kingsville, has recently completed the erection of a three-phase, 6600-volt transmission line between its Kingsville and Bishop plants, a distance of 6½ miles.

MAYPEARL, TEX.—The Texas Pwr. & Ltg. Co., of Dallas, it is reported, is contemplating installing an electric-lighting system in Maypearl. Electricity will be supplied from the plant in Dallas.

MONTAGUE, TEX.—A company is being organized for the purpose of installing an electric-light plant in Montague. W. A. Parker, of Dallas, is reported interested.

PALESTINE, TEX.—Plans, it is reported, have been adopted by the Texas Pwr. & Lt. Co. for the construction of a new electric light and power plant in Palestine, to cost about $83,000.

PALESTINE, TEX.—The general shops and division terminals of the International & Great Northern R. R. Co. will be equipped with electrically driven machinery and electric lamps. The cost of the equipment is estimated at $25,000.

Pacific States

TACOMA, WASH.—Within the next two months the Electric Light Department expects to purchase three 333-kva, 4000/6600 volt auto-transformers, three 333-kva, 6600/2300-volt auto-transformers, and material for 5 miles of three-phase primary lines. B. W. Collins is superintendent of electrical works.

TACOMA, WASH.—The Puget Sound Electro-Manganese Co., of Tacoma, which owns and is developing large mineral claims in the Olympic Peninsula, near Port Townsend, it is reported, contemplates the construction of a 100,000-hp power plant on the Snohomish River and the installation of 10 additional electric furnaces in its smelter in Tacoma. Several million dollars, it is understood, will be spent in development work, including the construction of power plants, erection of transmission lines, etc.

TACOMA, WASH.—The City Council, it is reported, has authorized the city attorney and B. W. Collins, superintendent of the electrical department, to draw up an agreement between the city of Tacoma and the Tacoma Central Htg. Co., which is controlled by the American Steam Htg. Co., for the maintenance of an auxiliary steam plant of not less than 6000 hp by the company, in return for which the City Council will grant the company a steam-heating franchise. The company, it is said, has agreed to furnish a 6000-hp generating unit as an auxiliary to the present municipal plant in exchange for a heating franchise.

COTTAGE GROVE, ORE.—Charles E. Wilkinson, owner of the Callapooya Springs at London, near here, contemplates the construction of an electric-lighting system. The plant will be driven by water-power.

VENICE, CAL.—The Abbot-Kinney Co. is reported to be contemplating the installation of an electric generating plant to cost about $70,000. J. B. Griffen is engineer in charge.

BOISE, IDAHO.—The Idaho Pwr. & Lt. Co. has filed a petition with the Public Utilities Commission for a certificate of convenience and necessity in Canyon and Washington Counties, particularly in the towns of Payette, Emmett, Parma and New Plymouth.

WALES, UTAH.—The Big Springs El. Co., of Fountain Green, has applied to the Town Board for a franchise to install and operate an electric-lighting system in Wales.

EVANSTON, WYO.—The Evanston El. Lt. Co. expects to erect within the next 30 days one 75-hp, 2300-volt motor-generator set directly connected to a 50-kw, 250-volt, direct-current generator in the Union Pacific Railroad shops. The equipment has already been purchased. H. L. Williams is manager.

WELLINGTON, COL.—The City Council has passed an ordinance granting the Western Ltg. & Pwr. Co. a franchise to construct and operate an electric-lighting plant in Wellington.

LORDSBURG, N. M.—The Lordsburg Wtr., Ice & El. Co. is contemplating the installation of new machinery in its electric plant.

Canada

NEWMARKET, ONT.—Within the next six months the municipal electric-lighting system will be rebuilt, for which $15,000 has been appropriated. Energy for operating the new system will be purchased from the Toronto & York Radial Ry. Co. at $25 per hp per year. The pole will be rebuilt and a new street-lighting system installed; new equipment for the power station will also be required. J. Morris is chief engineer.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer of the Panama Canal, Washington, D. C., under Circular 913, for furnishing switch or gang boxes, cable, lamp cord, condulets, inclosed fuses, push-button switch plates, receptacles, rosettes, key sockets, snap

switches, rubber tape, copper wire, circuit panelboards, conduit boxes, galvanized pipe conduit, outlet-box covers and wattmeters. For further information address Major F. C. Boggs, general purchasing officer.

PANAMA.—Bids will be received at the office of the general purchasing officer, Panama Canal, Washington, D. C., until April 26, for furnishing regulating valves, machines, motors, starting panels and limit switches for locks. Blanks and general information relating to this circular (No. 911) may be obtained at the above office or the office of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is purchasing officer.

PANAMA.—Bids will be received at the office of the general purchasing officer, Panama Canal, Washington, D. C., until April 16, for furnishing mechanical range indicators, ammeters, knife switches, sheet copper, cast-iron pipe and fittings, valves, asbestos gaskets, magnesia pipe covering, leather belting, etc. Blanks and general information relating to this circular may be obtained at the above office or from the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, New Orleans, La.

Directory of Electrical Associations

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, H. O. Hanson, Mobile Gas Co., Mobile, Ala.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Permanent secretary, L. O. Howard, Smithsonian Institution, Washington, D. C. Meeting, San Francisco, Aug. 2-7.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 29 West 39th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Annual meeting, Atlantic City, N. J., April 22-24.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary, Eugene W. Stern, 101 Park Ave., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Annual meeting, Deer Park, Md., June 29 to July 2.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS. Secretary, William H. Ross, 154 Nassau St., New York City.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, Edwin A. Scott, 29 West 39th St., New York.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, W. J. Tharp, Little Rock, Ark. Annual meeting, Little Rock, May 11-13.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. President, R. K. Sheppard, B. F. Goodrich Co., Akron, Ohio.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Assistant secretary, Walter Neumuller, Irving Place and 15th St., New York.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, W. T. Snyder, McKeesport, Pa.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 112 West Adams St., Chicago.

CALIFORNIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. S. Hanbridge, 1408 Merchants' National Bank Building, Los Angeles, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary-treasurer, Alan Sullivan, 10 Adelaide Street East, Toronto, Can.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION, N. E. L. A. Secretary, J. F. Becker, 130 East 15th St., New York.

EASTERN NEW YORK SECTION, N. E. L. A. Secretary, C. S. Van Dyck, Schenectady.

ELECTRICAL CONTRACTORS' ASSOCIATION OF MASSACHUSETTS. Secretary, H. D. Temple, 30 Foster St., Worcester, Mass.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russel, Jr., 25 West 42d St., New York.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE STATE OF PENNSYLVANIA. Secretary, M. G. Sellers, 1518 Sansom St., Philadelphia.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert Petermann, 626 Lloyd St., Milwaukee, Wis.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Meeting, San Francisco, second Thursday of each month.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Executive secretary, A. Jackson Marshall, 29 West 39th St., New York. Sections in New York, New England, Chicago, Philadelphia, Washington and Los Angeles.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St. New York.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla. Annual meeting, Oklahoma City, May 12-14.

GEORGIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. M. Clayton, Atlanta. Annual meeting, Atlanta, April 15.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, C. A. Littlefield, 29 West 39th St., New York. Annual convention, New Willard Hotel, Washington, D. C., Sept. 20-23.

INDEPENDENT TELEPHONE ASSOCIATION OF AMERICA. Secretary, W. S. Vivian, 19 South LaSalle St., Chicago.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

INDIANA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, George Skilman, Indianapolis, Ind.

INSTITUTE OF OPERATING ENGINEERS. Secretary, L. Houmiller, 29 West 39th St., New York.

INSTITUTE OF RADIO ENGINEERS. Secretary, David Sarnoff, 71 Broadway, New York.

INTERNAL COMBUSTION ENGINEERS' ASSOCIATION. President, Charles Kratsch, 416 West Indiana St., Chicago. Meeting second Friday of each month at Lewis Institute.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ENGINEERING CONGRESS. Secretary-treasurer, W. A. Cattell, Foxcroft Building, San Francisco, Cal. Congress, San Francisco, September.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England. Meeting at San Francisco, Sept. 9-11.

IOWA SECTION, N. E. L. A. Secretary, W. H. Thomson, Des Moines, Ia. Annual meeting, Keokuk, Ia., April, 20-22.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Ia.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia.

JOVIAN ORDER. Jupiter (president), Homer E. Niesz, Chicago, Ill.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary-treasurer, Ivor Thomas, 237 South Main St., Wichita, Kan.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. J. Ziegler, 227 Bourbon St. Meeting every Wednesday, Audubon Building, New Orleans.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Waterville, Maine.

MICHIGAN ELECTRIC ASSOCIATION. Affiliated with N. E. L. A. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich. Annual meeting June.

MINNESOTA ELECTRIC ASSOCIATION. Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the National Electric Light Association. Secretary-treasurer, H. F. Wheeler, Hattiesburg, Miss. Annual meeting, Hattiesburg, April 12-14.

MISSOURI PUBLIC UTILITIES ASSOCIATION. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis. Convention, May 27.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, Wm. L. Smith, Concord, Mass.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual meeting, Chicago, June 1-3.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York. Annual meeting, San Francisco, June 7-11.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y. Annual meeting, San Francisco, July 18-24.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Permanent headquarters, Room 204, Hotel LaSalle, Chicago, Ill.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, S. J. Bell, David City, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State St., Boston, Mass.

NEW ENGLAND SECTION, ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, L. L. Edgar, 39 Boylston St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. E. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, E. A. Thiele, Roswell, N. M.

NEW YORK ELECTRIC RAILWAY ASSOCIATION. Secretary, Charles C. Dietz, 365 East 21st St., Brooklyn, N. Y.

NORTHWEST SECTION, N. E. L. A. Secretary, N. W. Brockett, Pioneer Building, Seattle, Wash.

NORTHERN WHITE CEDAR ASSOCIATION. Secretary, R. N. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual meeting, Cedar Point, July 20-23.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary-treasurer, J. W. Oberender, Portland, Ore.

PENNSYLVANIA ELECTRIC ASSOCIATION (State Section N. E. L. A.). Secretary-treasurer, H. N. Müller, Pittsburgh, Pa.

RAILWAY SIGNAL ASSOCIATION. Secretary-treasurer, C. E. Rosenberg, Times Building, Bethlehem, Pa.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York. Annual meeting, New York, May 11, 1915.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa. Annual meeting, Ames, Ia., June 22-25.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, George H. Wygant, Tampa, Fla.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex. Annual meeting, Galveston, May 19-22.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. H. West, Rutland, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MARCH 23, 1915.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,132,552. ELEVATOR SIGNAL SYSTEM; J. D. Bowne, New York, N. Y. App. filed July 25, 1903. Control parts arranged and constructed so as not to get out of order.

1,132,568. ELECTRIC SIGNALING; R. A. Fessenden, Brant Rock, Mass. App. filed Oct. 31, 1907. High-speed wireless telegraphy.

1,132,569. WIRELESS TELEGRAPHY; R. A. Fessenden, Brant Rock, Mass. App. filed Feb. 18, 1909. Improved antenna construction.

1,132,588. WIRELESS TELEGRAPH RECEIVING APPARATUS; S. M. Kintner and J. W. Lee, Pittsburgh, Pa., and Brant Rock, Mass. App. filed June 24, 1912. Finding receiver combined with heterodyne receiver.

1,132,589. SPARK-CAP; F. H. Kroger, Brooklyn, N. Y. App. filed July 16, 1912. For wireless.

1,132,602. STARTER CONTROL FOR EXPLOSIVE ENGINES; H. A. Myers, Toledo, Ohio. App. filed May 15, 1914. Automatically switches ignition, after starting, from battery onto magneto.

1,132,604. ELECTRIC FLUID HEATER; T. J. Nash, Lincoln, Neb. App. filed Dec. 26, 1914. Adapted for ready attachment to water or electrical sources or for use as an immersion heater.

1,132,605. SIGNAL APPARATUS; H. F. Newbury, N. Y. App. filed Nov. 26, 1904. For elevators.

1,132,606. SIGNAL APPARATUS; H. F. Newbury, New York, N. Y. App. filed Nov. 26, 1904. Special car-operated switches.

1,132,607. ELEVATOR SIGNALING SYSTEM; E. R. Newell, New York, N. Y. App. filed May 24, 1911. Car operator can control restoration of signals.

1,132,613. TELEPHONE TRANSMITTER; J. C. R. Palmer, Brooklyn, N. Y. App. filed April 15, 1912. Of improved transmitting qualities.

1,132,653. CENTRIFUGALLY OPERATED CONTACT DEVICE; C. G. Cunningham, New York, N. Y. App. filed Sept. 9, 1913. Uses mercury as centrifugally operated bridging material.

1,132,654. AUTOMATIC CIRCUIT-CONTROLLING APPARATUS; C. G. Cunningham, New York, N. Y. App. filed Feb. 7, 1914. Special centrifugal control.

1,132,659. TIME-RECORDING APPARATUS; A. C. Jackson, Philadelphia, Pa. App. filed Feb. 7, 1913. Easily readable time-clock record.

1,132,661. METHOD OF PREPARING IRON FOR CASTINGS; W. G. Kranz, Sharon, Pa. App. filed April 17, 1911. Sulphur removed in electric furnace.

1,132,671. PROTECTIVE CASING FOR LINE CONDUCTORS; T. E. Murray, New York, N. Y. App. filed May 20, 1912. Metal-molding construction.

1,132,672. JUNCTION BOX; T. E. Murray, New York, N. Y. App. filed Oct. 16, 1913. Of condensed size for subway work, etc.

1,132,673. JUNCTION BOX; T. E. Murray, New York, N. Y. App. filed Jan. 31, 1914. Constructed of unit sections of metal tube.

1,132,674. ELECTRIC FUSE; T. E. Murray, New York, N. Y. App. filed March 28, 1914. Cartridge type; fuse and holding clips can be removed without taking off the end caps.

1,132,676. MULTIDUCT; T. E. Murray and A. V. A. McHarg, New York, N. Y. App. filed April 30, 1913. Made of sheet metal.

1,132,684. ROASTING OF COMPOUNDS OR ORES CONTAINING ZINC; A. L. J. Queneau, Philadelphia, Pa. App. filed July 19, 1911. Zinc blende roasted in electric furnace.

1,132,700. LOCK SWITCH FOR ELECTRIC CIRCUITS; S. M. Blake and J. W. Bates, Minneapolis, Minn. App. filed May 19, 1913. Operates burglar alarm for automobiles.

1,132,733. MAGNETO ADJUSTMENT; C. B. Rose, Moline, Ill. App. filed Sept. 3, 1912. Magneto shaft and sprocket-drive shaft in alignment therewith are simultaneously adjustable.

1,132,734. SUPPORTING STRUCTURE FOR TROLLEY CONDUCTORS; W. Schaake, Pittsburgh, Pa. App. filed June 14, 1912. Support for curves on high-speed electric railways.

1,132,739. SPOOL-WINDING MACHINE; C. Scott, Yonkers, N. Y. App. filed Sept. 5, 1906. Automatically stops upon detection of faulty section of wire being spooled.

1,132,741. CONTROLLER FOR ALTERNATING-CURRENT MOTORS; A. Simon, Milwaukee, Wis. App. filed June 1, 1909. Protecting means responsive to abnormal conditions in the secondary circuit.

1,132,750. ELECTRIC SWITCH FOR PORTABLE ELECTRIC LIGHTS; B. Tauber, New York, N. Y. App. filed Sept. 27, 1913. Operated by exposed slide on flashlight casing.

1,132,751. PORTABLE ELECTRIC LIGHT; B. Tauber, New York, N. Y. App. filed April 17, 1914. Construction of switch-operating slide.

1,132,765. COIL-TAPPING MACHINE; W. Deats, Yonkers, N. Y. App. filed Oct. 1, 1907. For irregular or non-circular coils (thirty-nine claims).

1,132,772. CIRCUIT INTERRUPTER; F. W. Harris, Wilkinsburg, Pa. App. filed Dec. 5, 1910. No-voltage; has special tripping device.

1,132,776. HORIZONTAL ARC LAMP; H. W. Hobbs, Portland, Maine. App. filed Feb. 24, 1910. For searchlamps.

1,132,783. ELECTROMAGNET; W. D. Lutz, Allendale Borough, N. J. App. filed Aug. 19, 1912. Constructed to overcome or prevent residual magnetism.

1,132,786. CIRCUIT INTERRUPTER; J. N. Mahoney, Wilkinsburg, Pa. App. filed Feb. 16, 1912. Has auxiliary arcing terminals.

1,132,791. AUTOMATIC STOPPING DEVICE; J. Pagano, Memphis, Tenn. App. filed Nov. 17, 1912. Short-circuits the ignition upon failure of oil supply.

1,132,799. LOCOMOTIVE; F. L. Sessions, Columbus, Ohio. App. filed March 7, 1910. Improvements in journal-box and connecting-rod constructions for electric mine locomotive.

1,132,838. LOCOMOTIVE; D. R. Fisher, Columbus, Ohio. App. filed April 16, 1910. Gearless electric mine locomotive.

1,132,846. ELECTRIC BATTERY; V. Holzapfel, Jr., Bayonne, N. J. App. filed June 25, 1912. Semi-dry type with replaceable elements.

1,132,849. TELLTALE SWITCH; J. Howland, San Antonio, Tex. App. filed March 10, 1914. Gives notice upon failure of vacuum in a fruit-drying or creosoting plant, etc.

1,132,884. ELECTRICAL RECORDING APPARATUS; A. L. Sohm, Los Angeles, Cal. App. filed Jan. 20, 1911. Entrance plate at workmen's entrance and registering mechanism in the office.

1,132,890. ELECTRICAL MEASURING INSTRUMENT; T. W. Varley, New York, N. Y. App. filed Oct. 10, 1907. Integrating wattmeter.

1,132,910. MACHINE FOR INTERMITTENTLY DISPLAYING POSTERS AND THE LIKE; E. W. Brown, Holborn, London, Eng. App. filed June 2, 1914. An intermittently advanced band carries the posters.

1,132,933. APPARATUS FOR DISTANCE GAS LIGHTING; E. W. Havers, London, Eng. App. filed Dec. 12, 1913. Simple and accessible for cleaning.

1,132,957. ELECTROLYTIC CONDENSER AND METHOD OF OPERATING THE SAME; R. D. Mershon, New York, N. Y. App. filed Jan. 4, 1910. Auxiliary exciting means for the condenser.

1,132,986. SYSTEM OF CHARGING AND DISCHARGING STORAGE BATTERIES DURING FORMING PROCESS; W. A. Turbayne, Buffalo, N. Y. App. filed Nov. 29, 1911. Obviates waste of current.

1,132,987. IGNITION APPARATUS FOR STARTING INTERNAL-COMBUSTION ENGINES; G. Unterberg, Durlich, Germany. App. filed March 26, 1912. Spring rotates armature to produce initial starting spark.

1,132,989. WELDING; E. L. Walker, Philadelphia, Pa. App. filed June 17, 1914. Wooden strips secured to metallic member by securing pins welded thereto.

1,132,992. DYNAMO-ELECTRIC MACHINE; J. J. Wood, Fort Wayne, Ind. App. filed July 1, 1912. Fractional horse-power; uses form-wound field coils.

1,132,997. SWITCH; V. G. Apple, Dayton, Ohio. App. filed June 8, 1914. Foot-operated, weatherproof starting switch for automobiles.

1,133,000. REGULATING DEVICE; A. Boury, Paris, France. App. filed July 16, 1912. Interrupter or cut-out for train-lighting systems.

1,133,013. INDICATOR OPERATING DEVICE FOR GASOLINE TANKS; C. Eberhart, Jr., Atlanta, Ga. App. filed May 20, 1913. Special float construction.

1,133,023. FLUID LEVEL INDICATOR; M. M. Hart and R. W. Carpenter, Weiser, Idaho. App. filed Feb. 27, 1914. Comprises a column having sections insulated from each other.

1,133,032. OIL SWITCH; E. H. Jacobs, Schenectady, N. Y. App. filed June 18, 1913. Resistance of the oil vessel is automatically introduced into circuit.

1,133,034. SELECTIVE - SIGNAL - TRANSMITTING APPARATUS; H. Joslyn and C. L. Lynch, Seattle, Wash. App. filed Aug. 4, 1909. Indicating apparatus is made operative through an extended closure of the circuit.

1,133,045. TIME RECORDER FOR VEHICLES; C. E. Larrabee, Binghamton N. Y. App. filed June 21, 1911. Gives both "coasting" time and time of trip.

1,133,053. IGNITION MAGNETO GENERATOR; H. C. Mueller, Milwaukee, Wis. App. filed July 17, 1913. Reversible and contained wholly within flywheel.

1,133,059. ELECTROLYTIC PROCESS OF PRODUCING COPPER; M. Perreur-Lloyd, Boulogne-sur-Seine, France. App. filed March 28, 1912. Constantly agitates electrolyte.

1,133,073. HEATING AND COOKING APPARATUS; R. F. Veneer, London, Eng. App. filed Sept. 27, 1913. Resistance conductor is surrounded by oil on like heat-transferring medium.

1,133,098. ELECTRIC HEATING AND COOKING STOVE; A. O. Christensen, Franklin Furnace, N. J. App. filed Sept. 25, 1914. Continual circulation of air over and through heating coils.

1,133,111. TELEPHONE-EXCHANGE SYSTEM; F. W. Dunbar, Chicago, Ill. App. filed Jan. 13, 1905. Thirty jacks and lights may serve for each section of the switchboard. (Fifty-one claims.)

1,133,112. TELEPHONE SYSTEM; F. W. Dunbar, Chicago, Ill. App. filed March 17, 1905. Includes a service meter. (Sixty-three claims.)

1,133,113. TELEPHONE SYSTEM; F. W. Dunbar, Chicago, Ill. App. filed Oct. 11, 1905. Automatic; includes coin return. (Seventy-three claims.)

1,133,167. AUTOMATIC GASOLINE SERVICE; S. F. Mioton, New Orleans, La. App. filed Jan. 8, 1914. Coin-controlled.

1,133,175. RELOADABLE CARTRIDGE FUSE; H. H. Oswald, Fort Ann, N. Y. App. filed June 18, 1912. Fusible link surrounded by granular material in a paper envelope which can easily be inserted in fuse casing.

1,133,176. LIGHTNING-ROD COUPLING; E. G. Owen, Janesville, Wis. App. filed April 19, 1913. Sheet-metal construction with clamping band.

1,133,178. PROJECTING APPARATUS; H. F. Patton, Cleveland, Ohio. App. filed June 21, 1909. Arc-lantern construction.

1,133,183. DEVICE FOR IGNITING FUSES; J. H. Reineke, Weitmar, Germany. App. filed Dec. 8, 1914. Uses high-frequency alternating current.

1,133,187. SYSTEM OF ELECTRICAL DISTRIBUTION; G. B. Schley, Milwaukee, Wis. App. filed April 30, 1909. Employing storage battery and booster for absorbing the load.

1,133,197. ELECTRIC GANG FITTING; G. B. Thomas, Bridgeport, Conn. App. filed Aug. 25, 1914. For Pullman cars, etc., where space is limited.

1,133,203. TRUCK; B. R. Van Kirk, Philadelphia, Pa. App. filed Jan. 21, 1914. Electric car truck made of pressed sheet metal.

1,133,231. LAMP HOLDER; H. C. L. Holden, London, Eng. App. filed March 26, 1914. Bayonet-socket type used in automobile headlights.